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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LONDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY'.)

CONDUCTED BY

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VOL. VII.—ELEVENTH SERIES.

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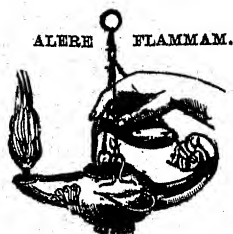
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“ Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ :—ex harum usu *bonitas* Creatoris ; ex pulchritudine *sapientia* Domini ; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata ; à verè eruditis et sapientibus semper exulta ; malè doctis et barbaris semper inimica fuit.”—LINNÆUS.

“ Quel que soit le principe de la vie animale, il ne faut qu’ouvrir les yeux pour voir qu’elle est le chef-d’œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations.”—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

..... The sylvan powers
 Obey our summons ; from their deepest dells
 The Dryads come, and throw their garlands
 And odorous branches at our feet ; the Nymphs
 That press with nimble step the mountain-thyme
 And purple heath-flower come not empty-handed,
 But scatter round ten thousand forms minute
 Of velvet moss or lichen, torn from rock
 Or rifted oak or cavern deep ; the Naiads too
 Quit their loved native stream, from whose smooth face
 They crop the lily, and each sedge and rush
 That drinks the rippling tide : the frozen poles,
 Where peril waits the bold adventurer’s tread,
 The burning sands of Borneo and Cayenne,
 All, all to us unlock their secret stores
 And pay their cheerful tribute

J. TAYLOR, *Norwich*, 1818.



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ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

"..... per litora spargite muscum,
Nalades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas
Ite, recurvato variata corallia trunco
Vellite muscois e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasi, Ecl. 1.

No. 37. JANUARY 1941.

I.—*The Cæcilians of the Seychelles.* By H. W.
PARKER, M.A., Department of Zoology, British Museum
(Natural History).

IN a recent review of the material collected during the Percy Sladen Expedition to the Seychelles (Parker, 1936 b) the author listed seven species of Cæcilians which have been recorded from these islands. These species were grouped, according to the commonly accepted views, in three genera; but there are now reasons for believing this grouping to be unnatural. Before proceeding to a consideration of the genera it was found necessary to revise the species and to re-assess the value of the few characters which are available for taxonomic purposes. As a result it was found that one species can be dropped from the list but another must be added, and that one distributional anomaly is non-existent, being the result of an incorrect locality-label. Several of the "specific" characters normally used for taxonomic work, whilst still valuable for their purpose, are found to vary with the absolute size of the specimens, and must, accordingly, be used with discretion.

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The variation to be found in the different characters may be summarized first, and the detailed measurements, on which the conclusions are based, will be listed under each species.

(1) *Number of Teeth*.—In the larva the maxilla is much less extensive than in the adult, bearing fewer teeth; immediately before metamorphosis the maxillary portion of the maxillo-palatine does not extend caudad beyond the eye, but when metamorphosis takes place there is a rapid increase in the length of the bone with a corresponding increase in the number of teeth. Although the greater part of this change is completed by the time all trace of the gills has disappeared, there appears to be some further increase in the number of maxillary teeth with age. But there is no corresponding change in the number of premaxillary teeth, which remains remarkably constant. The relative number of premaxillaries to maxillaries in adults is an index of the relative extent of the bones on which they are inserted, and may form a useful taxonomic character.

(2) *Position of the Tentacle*.—In the embryo the tentacle develops close in front of the eye and migrates forwards to take up its final position (see Brauer, 1898, pl. xxv.). This movement is not completed until after metamorphosis, so that the tentacular opening tends to be closer to the eye in younger specimens. The measurements made to obtain the ratios given in the following tables were made with an eyepiece micrometer in a straight line from the nearest point in the circumference of the eye to the centre of the tentacular opening and from that point to the centre of the nostril.

(3) *Tentacular Shape*.—Dunn (1928, p. 72) has already pointed out that the shape of the tentacular groove, often used in generic diagnoses, is "of little value, being hard to determine and dependent upon state of preservation and condition at time of fixation." I am unable to discover significant differences in tentacular shape in any of the Seychelles species examined.

(4) *Primary Folds*.—The number of these is very constant and shows no ontogenetic change.

(5) *Secondary Folds*.—The number of these, as is already well known, is very variable, but does not alter with size or age. The counts, as given here, are made from the

most anterior, recognizable fold, on whichever side it may lie, and each segment posterior to this point is counted as possessing a secondary, even though the fold may not be obvious.

(6) *Length/diameter Ratio*.—This is a very variable character and may be much influenced by preservation. To minimize this potential error the width of the head has been utilized instead of the width of the body, the skull being less prone to shrinkage. To ensure constancy the width has been measured at the line connecting the centres of the eyes, and calipers measuring to 0.1 mm. were used for the purpose. Dunn (*loc. cit.*) has reported that in the Central American forms examined by him this ratio "seems the same in young and adult," but, as the following figures will show, there seems to be a general tendency for the ratio to increase with size among the species found in the Seychelles.

Material has been examined of the following species, which are all considered as valid. The generic designation employed at this juncture is that under which the species was first described, and reconsideration of the grouping into genera is deferred until the characters of all the species have been considered.

(1) *Praslinia cooperi* Boulenger.

Praslinia cooperi Boulenger, 1909, Trans. Linn. Soc. London, Zool. (2) xii. 4, p. 293, pl. xl. fig. 1.

Premaxillary teeth 16–18; maxillaries 25 in juveniles to 29 or 30 in adults. Ectopterygoid well developed. Tentacle very close to the eye, the ratio tentacle-eye/tentacle-nostril 0.07 to 0.08; tentacle in a groove of the maxilla. Primary folds 83 to 85; secondaries 69 to 85 per cent. of the primaries. Ratio of length/head-width at centre of eyes 33 in juveniles to 34 in adults.

Material examined:—

Locality.	1. mm.	2.	3.	4.	5.	6.	7*.	
Praslin	166	16	25	83	71 (85 %)	33	·08	
Mahé	210	18	29	85	59 (69 %)	33	·07	Co-TYPES.
Praslin	230	18	30	85	63 (74 %)	34	·07	

* 1. Total length.

2. Premaxillaries.

3. Maxillaries.

4. Primary folds.

5. Secondary folds (per cent. of primary).

6. Ratio of length/head-width.

7. Ratio tentacle-eye/tentacle-nostril.

(2) *Dermophis sechellensis* Boulenger.

Dermophis sechellensis Boulenger, 1911, Trans. Linn. Soc. London, Zool. (2) xiv. p. 376, fig. 3.

? *Dermophis flaviventer* Ahl, 1926, Zool. Anz. lxxvii. 7/8, p. 192.

Premaxillary teeth 7; maxillaries 7 or 8 in juveniles, 8 or 9 in adults. Ectopterygoid absent. Tentacle twice as far from the nostril as from the eye, the ratio tentacle-eye/tentacle-nostril 0.38-0.5; tentacle in a groove of the maxilla. Primary folds 82 to 89; secondaries 71-90 per cent. of primaries. Ratio of length/head-width at centres of eyes 37 to 40 in juveniles, 50 to 57 in adults.

Material examined:—

Locality.	1.	2.	3.	4.	5.	6.	7.	
	mm.							
Mahé.....	74	7	8	86	66 (77%)	37	0.41	Co-TYPE.
"	80	7	7	84	?	40	0.38	
"	95	7	7	85	65 (77%)	50	0.43	Co-TYPE.
"	120	7	7	87	78 (90%)	50	0.44	Co-TYPE.
"	148	7	8	86	65 (75%)	51	0.5	Co-TYPE.
"	153	7	8	86	68 (79%)	55	0.5	Co-TYPE.
"	155	7	9	83	59 (71%)	52	0.5	Co-TYPE.
"	175	7	9	85	76 (89%)	53	0.43	
Silhouette ..	177	7	8	82	63 (77%)	51	0.46	
Praslin	189	7	9	89	67 (75%)	57	0.46	

Three larvæ from Mahé ascribed to this species have 7 premaxillaries and 4 maxillaries; 84, 85, and 87 primaries and 82, 84, and 82 secondaries; gills are lost, but a slit persists at 66-68 mm. length; the length/diameter ratio is 35 to 40.

Dermophis flaviventer Ahl, with 88 primaries and 60 (68 per cent.) secondaries, does not appear, judging from the description, to be distinct from *sechellensis*; the minor differences, viz., 12 teeth on each side of the upper jaw (vice 14-16) and the tentacle "not quite twice as far from the nostril as from the eye," are probably ascribable to different methods of measuring and counting.

(3) *Hypogeophis alternans* Stejneger.

Hypogeophis alternans Stejneger, 1893, Proc. U.S. Nat. Mus. xvi. p. 739.

Premaxillary teeth 8 or 9 (rarely, possibly as a result of injury, 11); maxillaries 9 to 15 in juveniles, 13 to 17 in

adults. Ectopterygoid well developed. Tentacle about midway between eye and nostril, the ratio of tentacle-eye/tentacle-nostril 1.0–1.3; tentacle in a groove or canal of the maxilla. Primary folds 83 to 88; secondaries 93 to 99 per cent. of the primaries. Ratio of length/head-width at centre of eyes 27 to 34 in juveniles, 34 to 45 in adults.

Material examined :—

Locality.	1.	2.	3.	4.	5.	6.	7.
	mm.						
Frigate Island	65	9	9	85	84 (99%)	27	1.0
" "	128	9	15	86	83 (96%)	33	1.1
" "	147	8	13	86	82 (95%)	34	1.1
" "	148	9	16	87	86 (99%)	36	1.1
Mahé.....	175	9	14	87	81 (93%)	38	1.3
Silhouette	197	9	16	83	79 (95%)	38	1.2
Frigate	210	{ 8 9 }	15	86	82 (95%)	45	1.3
"	230	8	16	85	83 (97%)	41	1.1
Silhouette	234	9	16	86	84 (97%)	38	1.1
"	238	9	{ 13 14 }	85	79 (93%)	37	1.0
Mahé.....	330	{ 9 11 }	17	85	81 (95%)	38	1.3

Comparable figures for the type from Mahé (taken from original description) :—

	about						
315	..	30	..	88	87 (99%)	37	1.0

(4) *Hypogeophis angusticeps*, sp. n.

Hypogeophis alternans (in part) Boulenger, 1909, Trans. Linn. Soc. London, Zool. (2) xii. p. 292; id. 1911, *op. cit.*, xiv. p. 375; Nieden, 1913, 'Das Tierreich,' Gymnophiona, p. 11; Parker, 1936, Trans. Linn. Soc. London, Zool. xix. p. 444.

This species has been confused with the preceding, but is recognizable by its much smaller head, fewer teeth, and less numerous secondary folds.

Premaxillary teeth 5 or 6; maxillaries 8 to 11 in juveniles, 9 to 12 in adults. Ectopterygoid present. Tentacle about midway between eye and nostril, the ratio of tentacle-eye/tentacle-nostril 1.1 to 1.4. Tentacle in a groove or canal of the maxilla. Primary folds 78 to 82; secondaries 66 to 90 per cent. of the primaries. Ratio of length/head-width at centre of eyes 44 in juveniles and 46 to 56 in adults.

Material examined :—

Locality.	1.	2.	3.	4.	5.	6.	7.	
	mm.							
Praslin	97	6	8	82	57 (69%)	44	1.2	1907.10.15.149
Mahé	128	6	11	81	59 (73%)	47	1.2	1910.3.18.72
"	130	6	10	80	55 (69%)	48	1.2	1910.3.18.71
"	133	6	11	81	62 (77%)	40	1.4	88.9.24.10
"	135	6	11	80	53 (66%)	46	1.3	88.9.24.11
Praslin	166	$\left\{ \begin{smallmatrix} 5 \\ 6 \end{smallmatrix} \right\}$	9	82	60 (73%)	50	1.2	1907.10.15.150
Mahé	170	6	9	80	58 (72%)	47	1.1	1910.3.18.70
"	173	6	11	81	73 (90%)	54	1.2	1910.3.18.88
Silhouette ..	183	6	$\left\{ \begin{smallmatrix} 11 \\ 12 \end{smallmatrix} \right\}$	78	57 (73%)	54	1.2	1907.10.15.145
Mahé	202	6	10	81	58 (72%)	56	1.2	1907.10.15.147

} PARA
Horo

Larvæ believed to belong to this species have 6 premaxillary and 5 maxillary teeth ; primary folds 77 to 81.

(5) *Oecilia rostrata* Cuvier.

Oecilia rostrata Cuvier, 1829, Règne Animal, ed. 2, ii. p. 100.

Hypogeophis guentheri Boulenger, 1882, Cat. Batr. Grad. Brit. Mus. ed. 2, p. 96, pl. vii. fig. 1.

Premaxillary teeth 5 or 6 ; maxillaries 6 to 10 in juveniles, 11 to 15 in adults. Ectopterygoid present. Tentacle about twice as far from the eye as from the nostril, the ratio of tentacle-eye/tentacle-nostril 1.6 to 2.4 ; tentacular foramen completely roofed in. Primary folds 96 to 104 ; secondaries 5 to 36 per cent. of the primaries. Ratio of length/head-width at centre of eyes 29 to 48 in juveniles, 46 to 62 in adults.

Material examined :—

Locality.	1.	2.	3.	4.	5.	6.	7.
	mm.						
Silhouette ..	63	6	6/7	98	6 (6%)	29	1.7
„ ..	65	6	6	100	5 (5%)	29	1.8
„ ..	65	6	7	99	5 (5%)	29	2.0
„ ..	68	6	8	98	9 (9%)	30	1.6
“ Zanzibar ”.	74	6	8	102	7 (7%)	37	1.8
Seychelles ..	77	6	9	100	7 (7%)	37	1.6
Mahé.....	121	6	10	102	34 (33%)	48	1.7
Praslin	146	6	$\left\{ \begin{smallmatrix} 11 \\ 12 \end{smallmatrix} \right\}$	103	5 (5%)	54	2.0
Silhouette ..	158	6	$\left\{ \begin{smallmatrix} 13 \\ 14 \end{smallmatrix} \right\}$	101	8 (8%)	51	1.7
Mahé	163	6	13	96	34 (36%)	51	1.8
„	164	6	13	100	19 (19%)	46	2.0
„	177	6	12	100	24 (24%)	51	2.0
„	180	$\left\{ \begin{smallmatrix} 5 \\ 6 \end{smallmatrix} \right\}$	14	101	8 (8%)	52	2.0
Curieuse ...	180	6	14	104	7 (7%)	58	2.0
Frigate	230	6	15	97	10 (10%)	56	2.0

Locality.	1.	2.	3.	4.	5.	6.	7.
	num.						
Mahe.....	232	6	$\left\{ \begin{smallmatrix} 13 \\ 14 \end{smallmatrix} \right\}$	100	11 (11%)	44	1.8
Frigate	240	6	15	97	5 (5%)	57	2.1
Praslin	244	6	14	102	8 (8%)	62	2.2
Mahe.....	245	6	14	102	23 (23%)	52	2.0
Cureuse ...	250	5	15	103	9 (9%)	54	2.4
Frigate	252	5	14	95	14 (14%)	50	2.3
..	255	6	$\left\{ \begin{smallmatrix} 14 \\ 15 \end{smallmatrix} \right\}$	97	7 (7%)	55	2.0
Silhouette ..	258	6	$\left\{ \begin{smallmatrix} 13 \\ 14 \end{smallmatrix} \right\}$	98	12 (12%)	53	2.0
"Zanzibar".	259	6	15	96	17 (17%)	47	2.1 { Type of
							<i>H. guentheri</i> .
Mahé	260	6	12	100	11 (11%)	54	2.3
Praslin	295	6	14	103	12 (12%)	58	2.2

As will be seen, the type of *H. guentheri* falls within the range of variation of *H. rostratus*, and must be regarded as a synonym. *H. guentheri* has hitherto been regarded as a Zanzibar endemic, and, as the only African representative of a genus otherwise confined to the Seychelles, has achieved some importance in zoogeographical considerations. It is now, however, obvious that the locality "Zanzibar" is an error. The only records of the occurrence of this cæcilian in Zanzibar are based on the type, received in the British Museum from a Captain Parrish in 1876, and some larvæ received from Sir John Kirk in 1868. It is significant that the only other reptile in Capt. Parrish's collection is the basis for the only reported occurrence of another Seychelles species, *Chamaeleon tigris* Kuhl, on Zanzibar; again, there is a single record of a Seychelles bat, *Coleura seychellensis* Peters, from Zanzibar, and this, too, was obtained from Capt. Parrish. The apparently confirmatory evidence provided by the larvæ sent home by Kirk is untrustworthy, for the specimens almost certainly represent two species, *rostratus* and *angusticeps*, both of which are Seychelles species. Kirk apparently never collected in the Seychelles himself, but that he received material from those islands is proved by the specimen of *Lycognathophis sechellensis* (Schlegel) obtained by him (Boulenger, p. 318).

(6) *Hypogeophis brevis* Boulenger.

Hypogeophis brevis Boulenger, 1911, Trans. Linn. Soc. London, Zool. (2) xiv. p. 375, fig. 1.

Premaxillary teeth 6; maxillaries 8 to 9. Skull not examined, but probably similar to that of *Cæcilia rostrata*.

Tentacle 4 to 5 times as far from the eye as from the nostril, the ratio of tentacle-eye/tentacle-nostril 4.3 to 5.0. Primary folds 67 to 68; secondaries 85 to 88 per cent. of the primaries. Ratio of length/head-width at centre of eyes 26 in juveniles, 49 in adults.

Material examined:—

Locality.	1.	2.	3.	4.	5.	6.	7.	
	mm.							
Mahé....	40	6	8	68	60 (88%)	26	4.3	PARATYPE.
„	112	6	9	67	57 (85%)	49	5.0	HOLOTYPE.

In addition to the foregoing species *Dermophis larvatus* Ahl, 1934, Zool. Anz. cvi. 11, p. 284, has also been described as from the "Seychelles." It is based on a very young specimen, 58 mm. long, said to be in the larval state, despite the absence of gills, gill-closets, or vestiges of these structures, and described as strongly ventro-dorsally depressed, with a laterally compressed tail bearing a dorsal fin-fold. Premaxillary and maxillary teeth are given as about 14 on each side, the tentacle is about three times as far from the nostril as from the eye, and there are about 85 folds, no distinction being made between primaries and secondaries. The number of teeth would correspond with that of juveniles of *Dermophis sechellensis*, *Hypogeophis angusticeps*, *Cæcilia rostrata*, or *Hypogeophis brevis*. The position of the tentacle in such a young specimen is not reliably diagnostic, but in larval *sechellensis* of even larger size (70 mm.) it remains closer to the eye, whereas in smaller, unhatched larvæ of *rostrata* (measuring about 40 mm.) it has moved further forward and is situated about halfway between eye and nostril. The tentacular position corresponds with that found in larval examples of *angusticeps* of the same body-length, but those have definite rudiments of the gills persistent and have, like all the other species, more numerous body-folds. For the present *larvatus* must be considered unidentifiable, though there is a possibility that it is based on a young specimen of *angusticeps* so badly preserved as to mask the numerous secondary folds; such a condition would account for the supposedly depressed body and perhaps for the reputed dorsal fin-fold in the tail. If the possibility is confirmed the name *larvatus* would have priority.

There remains to be discussed the generic status of

these species. The accepted grouping up to the present is as follows (Werner, 1931, p. 205):—

(i.) *Praslinia*. Monotypic (*P. cooperi*). Dermal scales present. Two rows of mandibular teeth. Tentacle globular, close to the eye. Parietal and paraquadrate separated.

(ii.) *Hypogeophis*. Genotype *H. rostratus*; other spp., *H. alternans*, *H. angusticeps*, and *H. brevis*. Dermal scales present. Two rows of mandibular teeth. Tentacle globular behind the nostril. Parietal and paraquadrate in contact. Ectopterygoid present.

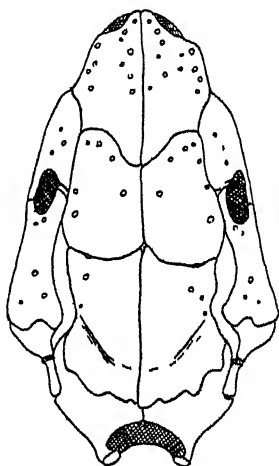
(iii.) *Dermophis*. Genotype *D. mexicanus*; other spp., *D. albiceps*, *D. crassus*, and *D. syntremus* in the Neotropical region; *D. thomensis* and *D. gregorii* in Africa; *D. sechellensis* and *D. larvatus* in the Seychelles. Dermal scales present. Two rows of mandibular teeth. Tentacle flap-shaped, usually nearer the eye than the nostril. Parietal and paraquadrate in contact.

The reference of some of the Seychelles cæcilians to *Dermophis* necessitates a consideration of the other species of that genus. In a recent paper de Jager (1939) has considered that the African and Neotropical species cannot be separated generically; but her conclusions were derived from a study of only two species, and were, moreover, based very largely on the consideration of characters (*e. g.*, cranial nerves and blood-vessels, internal anatomy of the olfactory apparatus, tentacle, and suspensorium) which have not yet received any consideration from taxonomists and which have not been investigated in more than about half a dozen species. It is consequently necessary to reconsider the various characters which may be of value for taxonomic purposes, and to try to assess their worth, having always in mind that, in zoology at any rate, systematists attempt to relate their scheme of classification to the phylogeny of the group, giving greater weight to some characters than to others.

(1) In all the species under consideration there are dermal scales, two rows of teeth in the mandible, the eye is not roofed over by bone, and the tentacle appears to have essentially the same structure.

(2) *Relation of the paraquadrate (squamosal) to the parietal*.—These bones were said to make contact in both *Hypogeophis* and *Dermophis*, but to be separated in *Praslinia*. Actually Wiedersheim (1879, p. 28) has shown that this is not the case in *Hypogeophis rostratus*, and Winsauer (p. 162) also has pointed out that in *alternans* the junction between the two is effected "through a broad band of cartilage" and that in a macerated skull there is a cleft ("Spalt"). De Jager (1939, p. 215) reports the presence of a similar small opening in the type-species of *Dermophis* (*mexicanus*) and in *D. gregorii*.

Fig. 1.



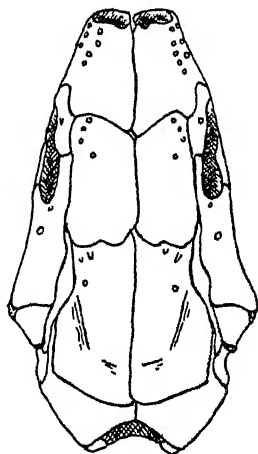
Hypogeophis rostratus (Cuvier). Skull in dorsal view.
Seychelles. $\times 7.5$.

Comparison of various skulls shows that this cleft between the squamosal and parietal is of approximately the same degree of magnitude in all the Seychelles species (including *Praslinia* and *Dermophis sechellensis*), but much smaller in the African species of *Dermophis* and in *D. mexicanus* (figs. 1-5).

(3) *Relations of quadrate and stapes*.—Marcus and his co-workers have paid considerable attention to the movability of the suspensorium, and have demonstrated that in *Hypogeophis* the quadrate and its associated

structures are movable, a special innervated muscle, the m. levator quadrati, being present. This necessitates a flexible union of the quadrate and stapes. In *D. mexicanus* and *D. gregorii*, however, this movability has been partly lost: the quadrato-stapedial articulation is lost, but the m. levator quadrati persists though lacking any innervation (de Jager). The latter author attaches great importance to this similarity between the American and African species, and the loss of kinesis may well have taxonomic value. But it is also fairly certain that this loss has taken place more than once in the Gymnophiona,

Fig. 2.



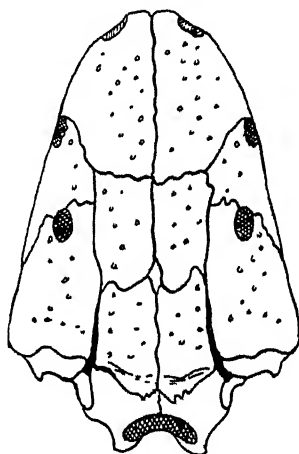
Hypogeophis sechellensis (Boul.). Mahé, Seychelles. $\times 9$.

with the possibility that the similarity between the American and African species may be due to convergence. De Villiers (1938) has shown that in *Scelecomorphus* the quadrate is immovable upon the paraquadrate and the m. levator quadrati wanting, whilst the quadrato-stapedial articulation is also lacking; in this instance, however, loss of the articulation has taken place in a different manner—by complete loss of the stapes. Again, in *Boulengerula* the same author (*loc. cit.*) reports that, although normally there is a quadrato-stapedial

articulation, one specimen shows the two elements in actual bony continuity."

The condition has not been thoroughly investigated in any of the other species involved in the present discussion, but superficial examination indicates that "*Dermophis*" *sechellensis* has a kinetic skull similar to that of *Hypogeophis alternans* and unlike that of *D. gregorii* or *D. mexicanus*; certainly it has a functional quadrato-stapedial articulation.

(4) *The stapedial style*.—The stapes is reported by de Jager to be a long narrow bone in *D. mexicanus* and

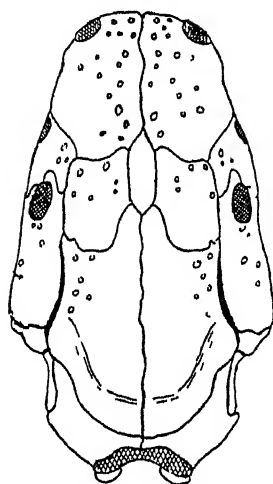


Dermophis mexicanus (Dum. & Bibr.). Teapa, Mexico. $\times 3$.

D. gregorii, with the stapedial style arising near its anterior end. In *Hypogeophis alternans* the style arises about the middle of the stapes, and the same condition is found in "*Dermophis*" *sechellensis*.

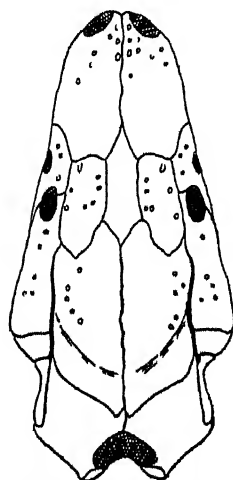
(5) *Relation of the frontal bones*.—In all the Seychellois species the frontals form a long median suture (figs. 1 & 2). In *D. mexicanus* (fig. 3) they are also in contact, though there may be a small gap between them posteriorly through which the mesethmoid appears as a small median element in the roof of the skull. In both African species of *Dermophis*, however, the frontals are very small and

Fig. 4.



Schistometopum gregorii (Boul.).
Lake Peccatoni, Kenya Colony. ×

Fig. 5.



Schistometopum thomense (Bocago). S. Thomé, W. Africa. × 6.5.

are widely separated in the middle line, the mesethmoid showing conspicuously (figs. 4 & 5). This feature was noted by de Jager in *D. gregorii*, but she appears not to attach any importance to it. It is not a character with any apparent functional significance, and it may reasonably be taken to indicate phylogenetic relationship.

(6) *Ectopterygoid*.—This small bone, considered by Marcus and his colleagues as the true pterygoid and by other authors as a post-palatine or transpalatine, is present in all the Seychelles species except *sechellensis*, and in the two African *Dermophis*; it is absent in *D. mexicanus*. It appears to be a variable bone, for its degree of development varies from species to species, and Marcus and his colleagues (pp. 161 & 175) report that, within the single species *Hypogeophis alternans*, it may be present as a discrete element or fused with the processus pterygoideus quadrati (=pterygoid) or maxillo-palatine. The present writer's experience suggests that either the specimen exhibiting this fusion was an anomalous individual, for in eleven specimens of *H. alternans* examined the bone is distinct, or, possibly, that there may have been some confusion of species, a specimen of *sechellensis* being involved. In the latter the bone appears to be constantly fused with the pterygoid and maxillo-palatine. It may be of phylogenetic significance that in the African species *Dermophis thomensis*, where the bone is present but apparently functionless, it is in process of being eliminated not by fusion but by becoming detached from the other bones; it lies loose in the connective tissue, and may be easily lost in the preparation of the skull.

(7) *The tentacular groove or canal*.—The groove in which the tentacle lies may remain open or, by overgrowth of the maxilla, become a completely closed canal. The condition varies to some extent with age, and there is often a good deal of individual variation. It should, however, be noted that in the Seychelles caecilians the closure only takes place in those species in which the tentacle is widely separated from the eye. Thus, in adults, there is a closed canal in *H. rostratus** (and also in *H. brevis*?), the condition is variable in *H. alternans* and *H. angusticeps*, but an open groove is the normal condition in

* Wiedersheim (1879, pl. ii. fig. 21) figures an open groove in this species, and the character may be variable.

sechellensis and *cooperi*, where the tentacle remains close to the eye. But in both the African species of *Dermophis* and in *D. mexicanus*, where the tentacle is also close to the eye, the normal adult condition is that of a closed canal.

(8) *Relations of the vomer to the internal nares*.—The extent of the vomer, measured by its entry into the margin of the posterior nares or its exclusion, has been claimed to be of taxonomic significance (Parker, 1936 (a), p. 160), but its value has probably been over-estimated, and some of the statements made there are incorrect. In a skull of *D. mexicanus* the vomer is excluded from the nares, but in "*D.*" *sechellensis*, *D. gregorii*, and all the species of *Hypogeophis* examined it enters their margin. In a skull of *D. thomensis*, however, it is found that both conditions are present, one on each side.

(9) *M. pseudotemporalis*.—This muscle, which appears to be a slip of the levator mandibulae anterior cut off by the passage through it of the ramus maxillaris of the fifth cranial nerve, is present as a distinct element in *Hypogeophis alternans* and *Dermophis mexicanus*, but is not distinct in *D. gregorii*. De Jager attaches little significance to its presence or absence, and Edgeworth does not recognize the muscle as a separate entity. It may nevertheless have some significance, since it is present in two other Neotropical genera besides *Dermophis* (*Cæcilia* and *Siphonops*) and in the Oriental *Ichthyophis*, but is absent in other African genera—*Scolecomorphus* and *Boulengerula*.

(10) *The olfactory organs*.—De Jager has described in detail the structure of the nasal region of *D. mexicanus* and *D. gregorii*, and, although she finds some minor differences between the two species, detects a general similarity and one feature which they have in common which appears to be unique in the Gymnophiona. In both the "Nebennasendrüse" open into the "Choanenschleimbeutel" instead of the more usual position of the "Nebennase." The detailed anatomy of the narial region is, however, known in so few cæcilians that the significance of this point cannot be gauged, though it must be emphasized that there are differences between *D. gregorii* and *D. mexicanus* in the position occupied by the "Choanenschleimbeutel" and in the size of the "Nebennasendrüse." Other differences between these two species are found in the degree of development of

the mucous alveoli of the "Schleimbeutel" and in the fact that the "Choanendrüse" are present in *mexicanus* but absent in *gregorii*, both characters whose value for taxonomic purposes cannot be estimated. Yet another difference pointed out by de Jager concerns the extent to which the sheath of the olfactory lobes is roofed over by the frontal, but this is undoubtedly a reflexion of the degree of development of these bones, a matter which has been discussed above (8).

From these considerations it seems tolerably certain that the so-called "*Dermophis*" *sechellensis* has more in common with the Seychelles species referred to *Hypogeophis* and to *Praslinia* than the Neotropical and African species with which it was previously grouped. This necessitates a fresh arrangement, for, if it be admitted into the same taxonomic series as *Praslinia* and *Hypogeophis*, these two can no longer be maintained as distinct groups, *sechellensis* bridging the gap. The cæcilians of the Seychelles can justifiably be considered as forming a single genus endemic in those islands; its name should be *Hypogeophis*. The African species referred to *Dermophis* certainly have many features in common with the Neotropical genotype, but they also have some other characters which are not found in *mexicanus* but which are present in other African cæcilians. This suggests that, although all three may have had a not-very-remote common ancestor, there has been divergence. To continue to place them in the same genus masks this divergence and creates a zoogeographical problem which scarcely exists.

The following grouping is accordingly proposed:—

I. HYPOGEOPHIS Peters.

Skull markedly zygokrotophic (figs. 1 & 2). Quadrate movable, with a functional quadrato-stapedial articulation and innervated m. levator quadrati; stapedial style arising near the middle of the stapes. Frontals large, forming a long median suture. Ectopterygoids usually distinct; tentacular groove remaining open in those species in which the tentacular opening is nearer the eye than the nostril. M. pseudotemporalis present. "Nebennasendrüse" opening into the "Nebennase."

Distribution.—Seychelles.

Genotype : *Cæcilia rostrata* Cuvier.

Species examined :—*H. brevis* (Boul.), *H. rostratus* (Cuv.), *H. angusticeps* Parker, *H. alternans* Stejneger, *H. sechellensis* (Boul.), and *H. cooperi* (Boul.).

II. SCHISTOMETOPUM, gen. nov.

Skull very slightly zygokrotophic (figs. 4 & 5). Quadrate not or only slightly movable, the quadrato-stapedial articulation obsolete and the m. levator quadrati lacking a distinct innervation. Stapedial style arising near the anterior end of the stapes. Frontals small, widely separated mesially. Ectopterygoids present. Tentacular groove roofed over. M. pseudotemporalis absent. "Nebennasendrüse" opening into the "Choanenschleimbeutel."

Distribution.—S. Thomé, W. Africa ; East Africa.

Genotype : *Dermophis gregorii* Boul.

Species examined :—*S. gregorii* (Boul.) and *S. thomensis* (Bocage).

III. DERMOPHIS Peters.

Skull only slightly zygokrotophic (fig. 3). Quadrate not or only slightly movable, the quadrato-stapedial joint obsolete and the m. levator quadrati lacking a distinct innervation. Stapedial style arising near the anterior end of the stapes. Frontals moderate, forming a median suture. M. pseudotemporalis present. "Nebennasendrüse" opening into the "Choanenschleimbeutel."

Distribution.—Central America.

Genotype : *Siphonops mexicanus* Dum. & Bibr. (No other species have been examined.)

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 WINSAUER. See MARCUS.

II.—Cryptini (formerly Mesostenini) of the Dutch East Indies (*Hym. Ich.*). By L. E. CHEESMAN, F.R.E.S.

THE material described in this paper is a small collection of Cryptini from the Buitenzorg Museum (Java) kindly lent by Heer M. A. Lieftinck, who himself collected some of it. A welcome opportunity is furnished for re-describing some of Cameron's types of Malaysian genera which are in the British Museum. Many of these genera are monobasic, and in several instances represented by a single specimen in a more or less mutilated condition. Cameron's work, although admirable when his many handicaps are taken into consideration, requires drastic revision. His diagnoses are not fundamentally incorrect, but many characters were overlooked which are used by hymenopterists to-day. The reason why Schmiedeknecht's monograph is almost useless is because it was based on Cameron's descriptions without an examination of types.

Any entomological material from Java is particularly valuable because of the greatly reduced indigenous insect fauna of that island, which is now confined to mountain tops. The rest of the land is under cultivation, for Java is densely populated by a very industrious, agricultural people, whose numbers are rapidly increasing. It is not generally recognized that the insects of Java ought to have been collected at least 200 years ago.

Key to the Genera.

- | | |
|---|-------------------|
| 1. Hind trochantellus viewed dorsally about as long as the hind trochanter | 2. |
| Hind trochantellus much shorter than trochanter (less than half as long) | 3. |
| 2. Nervulus strongly oblique. Ovipositor decurrent, ♂ antennæ distinctly thickened | <i>Buodias.</i> |
| 3. Propodeum with two longitudinal calli | <i>Cassula.</i> |
| Propodeum with no trace of calli | 4. |
| 4. Clypeus with two apical teeth | 5. |
| Clypeus simple at the apex | 6. |
| 5. Pronotum with epomiae ending dorsally in a large tubercle, appearing as a horn at the sides; upper margin of parapsides armed with a strongly curved spine | <i>Vagenatha.</i> |

- Pronotum with epomiae strong but not ending dorsally in a large tubercle *Fislistina*.
6. Propodeum evenly rounded from base to apex, distinctly wider than long, and very coarsely reticulate *Buysmania*.
- Propodeum with distinct dorsal and posterior planes *Skeatia* (*Goryphus* complex).

There is no definite character to separate *Goryphus* from *Ancaria* and *Skeatia*; therefore, until far more material is available, it is wiser to consider them as one genus. The form of the first abdominal segment is not a reliable character.

Table of Characters.

- Clypeus medially impressed at the apex. Genæ wider in lower half. Epomiae indistinct. Sternauli entire. Propodeum with two carinae. Spiracles of 1st abd. segment farther from one another than from the apex. Areolet of fore wing longer than wide. Nervulus antefurcal. *Buysmania*.
- Clypeus convex. Lower margin of genæ slightly bowed outwards. Epomiae and sternauli entire. Propodeum with one or two carinae. Spiracles of 1st abd. segment nearer apex than one another, or the distance equal. Areolet of fore wing quadrate. Nervulus slightly antefurcal or interstitial *Ancaria, Skeatia*.
- Clypeus bidentate. Genæ with lower margin roundly produced. Epomiae and sternauli entire. Propodeum with two carinae. Spiracles of 1st abd. segment nearer apex than one another. Areolet of fore wing as long as wide. Nervulus antefurcal *Fislistina*.
- Clypeus not separated from face at the base. Genæ rather wider in lower half. Epomiae and sternauli entire. Propodeum with one carina. Spiracles of 1st abd. segment more than twice as far from the apex as from one another. Areolet of fore wing longer than wide. Nervulus strongly antefurcal *Buodias*.
- Clypeus convex, flat apically. Width of genæ equal throughout their length. Epomiae and sternauli entire. Propodeum with deep longitudinal sulcus flanked by oblong calli. Spiracles of 1st abd. segment nearer one another than the apex. Areolet of fore wing slightly wider than long. Nervulus antefurcal *Cæsula*.
- Clypeus strongly raised apically, its truncate margin bidentate. Genæ with lower margin strongly, rather angularly produced. Epomiae and sternauli entire. Propodeum with carina buccately produced in the centre. Spiracles of 1st abd. segment nearer the apex than one another. Areolet of fore wing large, longer than wide. Nervulus strongly antefurcal *Vagenatha*.

1. GORYPHUS Holm., 1868, Eug. Resa Zool. vol. i. p. 399.
Genotype *basilarius* Holm. (China), in Upsala University Museum. Redescribed by Roman, Zool. Stud. Prof. Tullberg, p. 71, 1907, Upsala.

Goryphus must be regarded as a very elastic genus, including species differing in the form of the first abdominal segment and of the clypeus, and in the presence or absence of a posterior carina on the propodeon. Doubtless at a later period it will be possible to reconstruct the genus, but at the moment it appears wisest to retain it as a recognizable group until more has been done towards elucidating the recorded species and until far more material is available. In the following species the spiracles of the first abdominal segment are nearer the apical margin than one another, and the apical angles are acute.

Goryphus (Melcha) maculipennis Cam., 1905, Journ. Str. As. Soc. no. xxxix. p. 149 (♀), in B.M.

♀.—Black. Propodeon except anterior area, mouth-parts, and labrum pale red. Scutellum, tegulæ, mesopleural calli, apical margins of abdominal tergites 1, 2, 7, and 8, and a small macula on 6; white as follows:—fore coxa with fuscous base, middle coxæ (reddish in co-types), tarsal segments 2 and 3, apex of 1 on the hind tarsi. Trochanters, femora, and tibiæ of fore and middle legs red. Antennæ fuscous, with white annulus on segments 5–9. Wings hyaline with brown fascia, venation fuscous.

Colour variable, fore coxæ may be almost entirely fuscous and middle coxæ pale red.

Shining. Mandibles finely striate. Malar space half width of mandibles at their base. Clypeus and lower lateral areas of the face very sparsely, minutely punctate. Face flat, irregularly rugulose. Frons carinate, the centre with oblique rugæ. Distance between ocelli less than a third of that between them and eyes, which is little more than that between them and occiput. Back of head truncate, minutely punctate with short pubescence. Mesonotum very sparsely, finely punctate. Scutellum flat. Anterior area of propodeon with areola slightly wider basally; posterior area reticulate, carina distinct,

apophyses short, wide. First abdominal segment (fig. 1). Abdominal tergites densely punctate, second more coarsely than remaining. Propleuræ with short, coarse, transverse rugæ in the middle, upper angle glabrous. Mesopleuræ finely, densely reticulate. Metapleuræ with

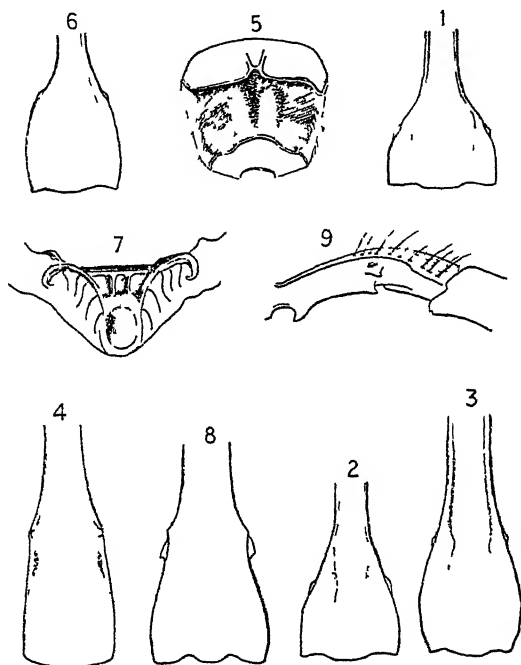


Fig. 1.—*Goryphus maculipennis* Cam., ♀. 1st abdominal segment.

Fig. 2.—*Buysmania* Cam., ♀. 1st abdominal segment.

Fig. 3.—*Skeatia* Cam., ♀. 1st abdominal segment.

Fig. 4.—*Buodias* Cam., ♀. 1st abdominal segment.

Fig. 5.—*Cæsula* Cam., ♀. Propodeum.

Fig. 6.—*Cæsula* Cam., ♀. 1st abdominal segment.

Fig. 7.—*Vagenatha* Cam., ♀. Spines of scutellum.

Fig. 8.—*Vagenatha* Cam., ♀. 1st abdominal segment.

Fig. 9.—*Vagenatha* Cam., ♀. 1st abdominal segment, lateral view.

coarse, regular reticulation, fore femora definitely swollen. Nervulus strongly antefurcal. Nervellus broken definitely below the middle.

Length 9 mm. Ovipositor 2 mm.

Distinguished from *mesoxanthus* by the strong posterior carina of propodeon.

rubra, var. nov.

Entire metathorax and all coxæ red. Labrum white.

Sumatra, Siberut Is., Mentawai, 1 ♀ (type), ix. 1924 (*H. H. Karny*), 1 ♀ (*C. B. K. & N. S.*); W. Java, Mt. Pantjar, viii. 1931, 1 ♀ (*M. A. Lieftinck*).

In specimen from Java the base of mandibles are white and clypeus red.

Goryphus (Cryptus) mesoxanthus Brullé, 1846, *Hist. Nat. Ins.* vol. iv. p. 196 (♀) (Java).

♀.—Black: labrum, mouth-parts, base of mandibles, mesopleural calli, tegulæ, scutelli, fore coxæ, and trochanters; apical margins of tergites 1, 2, 7, and 8, and annulus on flagellar segments 4–8, white. Propodeum and remainder of legs—except hind tibiæ and all tarsi, which are fuscus—red. Wings hyaline with fuscous macula. Venation dark brown.

Clypeus shining, with sparse, fine punctures. Malar space about half the base of mandibles. Face densely vermiculate. Frons weakly carinate, with oblique rugæ, laterally longitudinally aciculate. Back of the head shining, with sparse, minute punctures. Distance between hind ocelli and eyes equal to that between them and the occiput. Mesonotum sparsely punctate, the punctures shallow and very fine. Propodeum densely reticulate, also meso- and metapleuræ; propleuræ transversely reticulate, rugulose-striate in the upper half. Juxtacoxal area distinct, minutely reticulate. Hind coxæ finely, densely punctate. Nervellus broken definitely below the middle. 2nd abdominal tergite as wide as long.

Length 7 mm. Ovipositor 3 mm.

I have not seen the type of this species, but a specimen from Java in the British Museum answers to Brullé's description.

Goryphus mesoxanthus montana, var. nov.

Differs from typical form by the white macula on the clypeus.

W. Java, Djampang, Omg. Soekanegara, 700–1000 m., 1 ♀ (type), 13. x. 1935. Co-types as follows:—Tjibodas, 1 ♀ (undated); Tjibodas, 1 ♀, 28. iii. 1932; Buitenzorg, Tjampén, 1 ♀, xi. 1936; Mt. Panggerango, 1500 m., 1 ♀, 2. vi. 32 (*M. A. Lieftinck*). Djampang Tengah,

1 ♀, iii. 1933 (*M. E. Walsh*). In Buitenzorg Museum, Java.

2. FISLISTINA Cam., 1902, Journ. Str. As. Soc. xxxvii. p. 56. Genotype *F. maculipennis* Cam. (♀) (Borneo), in B.M. = *Lateva* Cam., 1902, *op. cit.* p. 60.

Redescribed.

♀.—Length of face from fore ocellus to apical margin of clypeus two-thirds of width including eyes. Mandibles triangular, slightly longer than wide, teeth equal. Clypeus not strongly raised, wider than long; sides laminate, not separated basally from the face, lateral foveæ deep; apical margin slightly impressed medially, sides of impression produced in two small teeth. Frons carinate. Head strongly narrowed beneath, the back truncate. Lower half of genæ rather wider, margin roundly produced. Notauli deep, with irregular rugosity between them at the apex. Scutellum triangular, length equals width, sides not carinate. Propodeum with two carinæ, the posterior carina more or less clearly defined; anterior area much shorter medially than at the sides. Apophyses short and wide. Form of the 1st abdominal segment resembles that of *Ancaria*, but is more robust. Epomiae and sternauli distinct in entire length. Areolet quadrate, outer nervure weak. Nervulus antefurcal.

Near *Goryphus* complex, but distinguished by the bidentate margin of clypeus.

Fislistina maculipennis Cam.

♀.—Black. Yellowish-white as follows:—labrum, mouth-parts, tegulæ, mesopleural calli, indistinct macula on upper margin of propleura, scutellum and postscutellum, two lateral maculæ on propodeum including apophyses; upper area of metapleura, large triangular fascia apically on abdominal tergites 1-3, 7 and 8, annulus of flagellum on segments 4-12, and apex of 3; fore coxæ and trochanters, base of hind tibiæ and hind tarsi. Legs red; inner side of fore and middle tibiæ, fore and middle tarsi, hind tibiæ fuscous. Wings hyaline, with a wide fuscous fascia, venation dark brown.

Shining. Length of mandibles $1\frac{1}{2}$ their width. Malar space less than half base of mandibles. Clypeus sparsely, finely punctate basally. Face weakly buccate in the

middle, with oblique, transverse rugæ. Frons distinctly carinate, strongly in upper half, with short longitudinal rugæ, sides and vertex matt. Distance between ocelli less than half that between them and eyes, which is about two-thirds of that between them and occiput. Back of head truncate, with sparse, minute puncturation. Mesonotum minutely punctate, notauli finely crenulate. Basal suture of scutellum deep, coarsely crenulate. Anterior area of propodeum finely reticulate, carina strongly incurved medially; posterior area rather coarsely reticulate, finely and transversely in the middle, with a short undulate longitudinal carina; posterior carina indistinct in the dense surface sculpture. Apophyses short, wide, and blunt. First abdominal tergite unsculptured except laterally at the apex; second tergite slightly wider than long, base nearly half the apex; third tergite short, length one-third of width. All tergites very densely, finely reticulate-punctate to their apical margins, second and third rather more coarsely. Propleura with oblique transverse rugæ medially, and a few fine oblique striæ in upper angle. Mesopleura densely transverse rugose in middle of upper half, weakly below. Metapleura reticulate, juxtacoxal area separated by a strong carina. Areolet slightly longer than wide. Nervulus slightly antefurcal, nervulus broken just below the middle.

Length 12 mm. Ovipositor 4 mm. Vestiture long, abundant.

Fislistina (Lateva) albopalteata Cam., 1902, *op. cit.* p. 60.

Type in B.M.

♀.—Black. Mouth-parts fulvous; antennæ dark brown. 1st abdominal segment, fore and middle legs except tarsi, hind coxæ, entire femora except apex, and base of tibiæ (white in some specimens) fulvous; remainder of legs fuscous. Apical margin of 2nd tergite and entire 7th white. Wings hyaline, with apex and transverse band fuscous, venation dark brown. Vestiture grey. White annulus of antennæ incomplete, from apex of 3rd segment to middle of 9th.

Shining. Mandibles minutely punctate, malar space about one-fourth of width of mandibles. Face sparsely, finely punctate, marginal teeth of clypeus strongly produced; supraclypeal area with longitudinal striæ,

vermiculate laterally. Centre of frons with irregular, curved rugæ. Vertex and back of the head with sparse microscopic puncturation; distance between hind ocelli about half that between eye and ocellus, which is about two-thirds of that between ocelli and occiput. Mesonotum minutely punctate with sparse pubescence. Basal suture of scutellum coarsely crenulate, scutellum glabrous. Basal area of propodeum with sparse microscopic puncturation, posterior area coarsely, irregularly reticulate.

Metapleura faintly reticulate. Mesopleura matt except speculum, with short transverse rugæ in the sulcus and anterior suture. Propleura with coarse transverse rugæ in the sulcus, which in the lower half extend to the posterior margin. First abdominal tergite shining; 2nd slightly longer than wide, narrowed basally, the apex $2\frac{1}{2}$ the width of 1st tergite, densely, finely reticulate, punctate more coarsely at the base, gastrocœli indistinct; 3rd with length less than half its width, matt, with microscopic punctures emitting short hairs; remaining tergites with similar surface sculpture. Areolet quadrate, length equal to width, 2nd recurrent nervure received slightly beyond the middle; discoidal nervure bowed outwards at basal third. Nervulus antefurcal: nervellus broken below the middle. Length of ovipositor from 3rd abdominal segment to apex of abdomen.

Length 10 mm.

Borneo, 1 ♀, 31. xi. 98 (type); 2 ♀♀, 1902; Sarawak, Mt. Matang, 2000 ft., 1 ♀, 22. xi. 1913 (*G. E. Bryant*), B.M. Sumatra, Sipora Is., 1 ♀, 1. xi. 1924, 1 ♀, 15. x. 1924 (*H. H. Karny*), Buitenzorg Museum, Java.

Fislistina (Buodias) annulipes Cam., 1909, Deutsch. Ent. Zeitschr. p. 532, ♀ (Borneo). Type in B.M.

Differs from the foregoing species in the following:—Large white macula on face and a pair on upper orbits; large fascia on second abdominal tergite and triangular fascia on third tergite. Second tergite definitely wider than long, width of apex two and a half the base; width of third tergite two and a half its length.

3. *BUYSMANIA* Cam. (MS. name). Genotype by present designation *B. reticulata* Cam. (MS. name), in B.M.

♀.—Face very definitely wider than long. Mandibles definitely longer than wide, narrowed apically, lower tooth

shorter. Clypeus not separated basally from the face, convex but not strongly, the convexity medially impressed at the apex, exposing the marginal lamina, which is slightly bowed outwards. Genæ much wider in the lower half, margin strongly, angularly produced. Face buccate in the middle. Back of the head truncate, rounded at the sides below the eyes. Pronotum with notauli scarcely converging apically, united by very coarse irregular reticulation. Scutellum wider than long. Propodeum wider than long, rounded from base to apex, anterior area short, posterior carina present laterally, the middle obscure, very slightly laminate in place of apophyses. First abdominal segment widened suddenly apically (fig. 2), spiracles much nearer apex than one another; sides strongly carinate. Epomiae indistinct. Sternauli entire. Areolet of fore wing rather large, longer than wide, outer nervure weak. Nervulus antefurcal.

Distinguished by the form of the propodeum and clypeus.

Buysmania reticulata Cam.

Black. Yellow markings as follows: base of mandibles, face except border of clypeus; upper part of genæ, vertex, and frons except at orbits; pronotal collar and calli, scutellum, macula on parapsides, two large lateral maculae on propodeum; fore and middle coxæ and trochanters; large macula on hind coxæ behind, hind tarsi except basal half of 1st segment; apical margin of all abdominal tergites, wider laterally, the 3rd narrower than the remainder; tegulae, mesopleural calli, annulus of flagellum on segments 5 (apex) to 9; remainder of legs red except hind coxæ and trochanters; apical two-thirds of hind tibiae and base of first tarsal segment fuscous. Scape black, flagellum fuscous. Venation dark brown. White apical margins of abdominal tergites, the third narrow, wider laterally.

Shining. Base of mandibles striate. Malar space more than half base of mandibles. Face coarsely, irregularly rugulose, with a few punctures on the clypeus. Frons with irregular rugosity and distinct carina. Back of head glabrous. Distance between hind ocelli about half that between them and eyes, which is slightly greater than that between them and occiput. Notauli very coarsely reticulate, with very coarsely reticulate area

apically, also in basal suture of scutellum and parapsidal sutures. Propodeum with very coarse regular reticulation, continuing on the metapleuræ, finer on mesopleuræ : juxtacoxal area separated from metapleuræ by a strong carina. Propleuræ coarsely rugose-reticulate. First abdominal segment with a few coarse shallow punctures apically ; width of second segment about five-eighths of length, coarsely punctate, the punctures denser and slightly smaller towards the apex ; third very densely punctate, more sparsely and finely on remaining tergites. Areolet of fore wing longer than wide, 2nd recurrent nervure received beyond the middle of cubitus ; nervulus definitely antefurcal ; nervellus broken at a strong angle at about the lower third.

East Java, Lawang. 1 ♀ (*Buysman*). Cameron's collection. 1914. B.M.

4. *SKEATIA* Cam., 1901, Proc. Zool. Soc. vol. ii. p. 39.
Genotype *S. nigrispina* Cam. (Malay Peninsula).
in B.M.

Redescribed.

♀.—Length of face from fore ocellus to apical margin of clypeus two-thirds of width including eyes. Mandibles longer than wide, teeth equal. Clypeus transversely convex, flat at the base and not separated from the face. Lower margin of genæ angularly, laminately produced. Ocelli large. Back of head truncate. Notauli with small rugose area apically. Scutellum slightly longer than wide. Propodeum armed with long apophyses, bicarinate, the posterior carina indistinct. 1st abdominal segment widened gradually to the apex (fig. 3), spiracles nearer one another than the apical margin, sides slightly rounded between spiracles and apex. Epomæ distinct, entire. Sternauli entire. Nervulus strongly antefurcal. Areolet of fore wing quadrate, outer nervure weak.

Belongs to the *Goryphus* complex.

Skeatia nigrispina Cam. *op. cit.* p. 41.

♀.—Black ; obscurely white macula in middle of face ; large macula on 7th and 8th tergites, white. Fore and middle legs fulvous-white, except tibiæ, which are fuscous, and tarsi dark brown ; of hind pair, coxæ fulvous, trochanters, femora, and tibiæ black, tarsi ivory. Wings

hyaline, venation dark brown. White, incomplete annulus of antennæ on segments 4-10 and base of 11.

Shining. Mandibles densely, minutely punctate, width more than three-quarters the length. Malar space more than half width of mandibles. Clypeus apically truncate, apical lamina slightly emarginate, finely punctate; remainder of face very densely, irregularly, finely sculptured. Frons with short median carina, rather coarse, irregular sculpture in the middle of the upper half and short, longitudinal rugæ laterally. Distance between hind ocelli slightly more than half that between them and the eyes, which is two-thirds of that between them and the occiput. Back of head and genæ with sparse minute puncturation. Mesopleuræ minutely sparsely punctate, sides of notauli and lateral margins transverse rugulose. Scutellum with distinct rather fine punctures. Anterior area of propodeum longitudinally reticulate, rugose laterally, much shorter medially; posterior area with very coarse, regular reticulation, truncate below the carina. Propleuræ densely transversely rugose, speculum with a few minute punctures. Metapleuræ regularly and densely, transversely reticulate-rugose; juxtacoxal area not distinctly separated from metapleuræ. First abdominal tergite with the centre raised apically, and sides depressed with a few fine punctures; second segment longer than wide; remaining tergites very densely, finely punctate to their apical margins. Hind coxæ and trochanters long. Ovipositor with a long, slender apex. Nervellus broken at the lower third.

Malay Peninsula, Bukit Besar, 1 ♀, Borneo, Sarawak, Mt. Matang, 3 ♀♀, xii. 1913, and i. 1914 (*G. E. Bryant*).

Other species belonging to this genus are:—*flavipes* Cam. (Borneo), *balteata* Cam. (Borneo) (*Buodias*) *maculipennis* Cam. (Borneo); but *carinata* Cam. (Borneo) and *cyclosiæ* Cam. (Ceylon) are not congeneric; *albispina* Cam. (Malay Peninsula) belongs to *Buodias*.

5. BUODIAS Cam., 1902, Journ. Str. As. Soc. xxxvii. p. 65. Genotype *ruficoxis* Cam. (Borneo), in B.M. Redescribed.

Buodias ruficoxis Cam. *op. cit.* p. 65.

♀.—Black; upper half of mandibles dark brown. Mouth-parts, sides of scutellum, fasciæ on abdominal

tergites 7 and 8, annulus of flagellum on segments 4-9, and base of 10th white. Legs red, fore tarsi darker : middle femora and tarsi, hind femora, tibiae except base, and tarsi fuscous. Wings hyaline, venation black.

Shining. Length of face slightly more than three-quarters of the width. Mandibles large, strongly convex basally in the upper half, slightly longer than wide, matt, striate below in the basal half. Malar space rather more than half base of mandibles. Clypeus not separated from the face basally, densely punctate except the apex, which is almost truncate, with a straight margin. Face coarsely rugulose, flat. Cheeks a little wider in lower half, margin laminate, roundly produced. Frons deeply depressed with a short, strong carina, the upper half emitting transverse rugæ. Vertex depressed in the centre ; distance between ocelli less than half of that between them and the eyes. Back of head truncate, sharply declivous behind the eyes. Mesonotum finely punctate, notauli, converging at the apex, with slight rugulosity. Scutellum longer than wide, sides carinate almost to the apex, rather sparsely and finely punctate. Parapsides coarsely longitudinally rugose. Propodeum sparsely, finely punctate in anterior area, which is scarcely narrowed medially ; areola wide, posterior area densely transverse rugulose, the rugæ coarse, reticulate laterally and continued on the metapleuræ ; posterior area with short, wide apophyses. Mesopleuræ reticulate in lower half, transversely rugose in upper half. Epomia and sternauli entire. Juxtacoxal area of metapleuræ not separated. Propleuræ coarsely, densely, transversely rugose, upper angle finely, densely punctate, margin rounded, with short transverse rugæ. 1st abdominal segment widened gradually to the apex, distance between spiracles half that between them and the apex (fig. 4) ; tergite finely granulate, the remaining tergites very densely, finely, reticulate-punctate ; 2nd tergite long, width nearly two-thirds of the length. Ovipositor strongly decurrent. Hind trochantellus long, about as long as the hind trochanter. Areolet of fore wing definitely longer than wide, the second recurrent nervure received near the apex. Nervulus strongly oblique, antefurcal. Nervellus broken definitely below the middle.

Length 15 mm. Ovipositor 4 mm.

1 ♀ (type), Borneo ; 2 ♀♀, Sarawak, Borneo, 1900.

Buodius (Skeatia) albispina Cam., 1901. Proc. Zool. Soc.
vol. ii. p. 40. ♂.

♀.—Hitherto undescribed.

Black. Mandibles (except tips) and apices of apophyses yellowish white; mouth-parts, fore legs except tarsi, femora above infusate; middle coxæ and trochanters and hind coxæ fulvous; annulus of antennæ, apex of 4th segment, and 5th to 10th entirely, hind tibiæ, maculæ on 7th and 8th abdominal tergites, white; remainder of middle legs and fore tarsi fuscous; remainder of hind pair blackish. Wings hyaline, venation dark brown.

Length of face two-thirds of width (including eyes). Mandibles almost twice as long as wide, not buccate at the base, sparsely punctate. Malar space half the width of mandibles. Genæ slightly narrower in lower half, margin weakly roundly produced. Clypeus not separated basally from the face, rounded apically. Face coarsely rugose at the sides, frons strongly carinate, with curved, transverse rugæ. Vertex matt, minutely punctate. Ocelli large, distance between them twice that between them and the eyes, which is slightly more than half of that between them and the occiput. Back of head truncate, with minute puncturation, sides of the head definitely incurved below the eyes. Occipital margin strong. Notauli converging apically, with slight rugosity. Scutellum longer than wide, sides carinate for half the length. Propodeum with anterior area irregularly sculptured, areola wide, narrowed apically, transverse carina only slightly shorter medially; posterior area truncate, coarsely reticulate; apophyses wide and rather long. Metapleuræ coarsely reticulate, distinctly separated from the juxtacoxal lamina. Mesopleuræ coarsely transverse rugose; propleuræ shagreened in upper half, with very coarse transverse rugæ below. Epomæ and sternauli distinct, entire. Abdomen as in *ruficoris*, width of third tergite twice its length, ovipositor decurrent but not strongly. Nervulus almost vertical, antefurcal: nervellus broken at the lower 6th.

Length 13 mm.

Borneo, Sarawak, Mt. Matang, 1000 ft., 1 ♀, 14. ii. 1914
(*G. E. Bryant*).

Buodias turbidus, sp. n.

Type in Buitenzorg Museum, Java.

♂.—Black; white as follows: mouth-parts, face including labrum, base of mandibles and clypeus, mesopleural calli, sides of scutellum, macula on parapsides, semi-circular macula on propodeum (including apophyses), apical margins of tergites 1, 2, 3, 7, and 8 (on 1 very narrow); annulus of flagellar segments 10–17, and macula at base of 18; fore tarsi, 1st tarsal segment of middle pair, apical half of 1st tarsal segment and remaining segments (entirely) of hind legs. Fore legs, coxæ and trochanters of middle pair, and coxæ of hind pair red. Upper side of middle femora fuscous. Hind pair of legs (except coxæ) and middle tarsi black. Wings pale brown, venation fuscous.

Shining. Mandibles basally convex but not strongly. Malar space about two-thirds of the width of mandibles. Clypeus finely striate-punctate. Face rugulose. Frons with short carina and transverse rugæ. Back of the head finely, sparsely punctate. Mesonotum with sparse fine punctures; on scutellum very sparse. Propodeum with anterior area finely punctate laterally; posterior area with dense, transversely curved, irregular rugæ, the slope short, half the length of dorsal area, apophyses represented by weak tubercles. First abdominal segment very slender, spiracles beyond the middle, prominent. Areolet slightly narrower at the base. Nervellus broken definitely below the middle.

E. Borneo, Midden, 1 ♂, ix. 1925 (*H. G. Sieber*).

This may be the ♂ of *ruficoxis* Cam., but cannot be definitely assigned to that species until more material is examined.

6. *CÆSULA* Cam., 1905, Journ. Str. As. Soc. xliv. p. 146.

Genotype *fulvipes* Cam. (Borneo), in B.M.

Redescribed.

♀.—Face wider than long. Mandibles longer than wide, tapering to the apex, teeth equal. Width of cheeks almost the same throughout their length, lower margin scarcely produced. Frons not carinate. Head very strongly narrowed beneath, so that the sides below the eyes appear almost horizontal. Back of head truncate,

but not sharply. Ocelli large. Notauli distinct, entire. Scutellum longer than wide. Propodeum with anterior area long at the sides, posterior area with a deep longitudinal sulcus, its sides raised, forming oblong calli (fig. 5); transverse carina laminately produced in the place of apophyses. Epomia and sternauli entire, 1st abdominal segment with spiracles situated before the middle, nearer one another than the apex (fig. 6); sides bicarinate. Areolet of fore wing slightly wider than long, outer nervure absent, inner nervure oblique. Nervulus antefurcal; nervellus broken below the middle. ♂ unknown.

A very distinct genus, characterized by the structure of the propodeum and form of the 1st abdominal segment.

Coesula fulvipes Cam. *siporensis*, subsp. n.

♀.—Black; mandibles (except teeth), scapes in front, macula on upper area of metapleuræ and lower two-thirds of lower area; femora and tibiæ of fore legs, coxæ, femora and tibiæ of hind legs yellow-red. Coxæ, trochanters and a macula on upper, outer side of tibiæ of fore legs; trochanters and a macula on upper, inner half of tibiæ (outer side fuscous) of middle pair; trochanters, upper third of tibiæ, and entire tarsi of hind pair white. A pair of triangular lateral maculæ on vertex, large macula at apex of notauli, tegulæ and mesopleural calli; scutellum and post-scutellum; posterior area of propodeum except near basal carina between calli and at the sides; annulus of antennæ; apical margins of abdominal tergites (except 5th and 6th) and a macula near the apex of 1st ivory. Fore and middle tarsi and hind trochantelli, flagelli, back of scape and venation dark brown. Wings hyaline. Vestiture whitish.

Head shining. Mandibles minutely, sparsely punctate, malar space a third of their width at the base. Clypeus with a few minute punctures. Face densely, finely rugulose, with a flattened tubercle between the antennæ continuing as a carina, emitting transverse rugæ. Centre of face irregularly rugose, lateral areas granulate. Frons shining, weakly buccate each side of the middle. Notauli deeper in the apical half, distinctly crenulate; mesonotum very finely, densely punctate. Basal area of propodeum densely, finely punctate with sparse hairs.

Propleuræ minutely punctate, transversely rugose in the sulcus, the lower rugæ extending to the posterior margin. Mesopleuræ with fine, dense transverse rugæ, speculum minutely punctate. Metapleuræ finely, densely transverse striate. 2nd and 3rd abdominal segments as long as wide, matt, densely finely reticulate-punctate; remaining segments very finely punctate.

Length 8 mm. ♂ as ♀.

Sumatra, Sipora Is., 1 ♀ (type), 1 ♂, 21. viii. 1924 (*H. H. Karmy*). In Buitenzorg Museum, Java.

Differs from the typical form in its smaller size (length of ♀ *fulvipes* is 10 mm.), also in having far more of the ivory pattern.

VAGENATHA Cam., 1901, Hym. Skeat Expedition, Proc. Zool. Soc. p. 41. *Acleasa* Cam., 1902, Journ. Str. As. Soc. vol. xxxvii. p. 35. Genotype *V. spinosa*, Hym. Skeat Exp. p. 42 (Borneo) = *armata* Cam. (*Acleasa*).

Redescribed.

♀.—Face including eyes, which are large, wider than long. Mandibles triangular, teeth equal. Clypeus strongly raised apically and strongly produced above and beyond the truncate apex, which is bidentate in the middle, distinctly separated from the face at the base. Frons carinate. Back of head strongly narrowed beneath, sides below eyes sharply declivous. Genæ about the same width throughout their length, lower margin strongly, rather angularly produced. Notauli converging at the apex. Scutellum raised in apical half, upper margin of parapsides armed with a conspicuous curved spine near base of wings (fig. 7). Propodeum entirely, coarsely reticulate, anterior area short medially; posterior area armed with long apophyses. First abdominal segment widened gradually to the apex (fig. 8), spiracles nearer one another than the apex; lateral margins carinate, with two coarse, curved spines (fig. 9), abdominal tergites raised in the basal half. Epomixæ and sternauli distinct, entire. Mesopleural calli produced backwards into spines, pronotal angles strongly produced laterally. Areolet of fore wing large, longer than wide; nervulus strongly antefurcal; nervellus broken at about the middle.

Vagenatha spinosa Cam.

Redescribed.

♀.—Black; with dense, long silvery pubescence. Yellow markings as follows: clypeus, mouth-parts, bases of mandibles, scapes except laterally, pronotal calli, scutelli, tegulæ (except small macula), mesopleural calli, horse-shoe pattern on propodeum including apophyses; fore and middle legs except stripe on upper side of femora and lower side of tibiæ, tarsal segments 1 and 2 except apex; hind coxæ except large macula on outer side, basal half of femora on underside, apical two-thirds of tibiæ except the base, and all tarsi; base and apex of 1st abdominal tergite, apical margins of remaining tergites, wider laterally. White annulus of antennæ complete, segments 5-10, and underside of 4 and 11. Wings hyaline, venation dark brown.

Shining. Mandibles slightly longer than wide, longitudinally striate at the base. Clypeus with sparse punctures; malar space one-third of the width of mandibles. Face with irregular longitudinal rugæ, transverse on frons, vertex unsculptured. Back of head sparsely, obliquely striate and punctate, space between hind ocelli one-fourth of that between them and the eyes, which is about two-thirds of that between them and the occiput. Pronotal calli strongly and angularly produced outwards. Mesonotum with rather fine irregular sculpture except the middle of the lobes which are rough but unsculptured, the sides of notauli and margins coarsely reticulate. Scutellum with a fringe of long, erect hair. Regular coarse reticulation of the propodeum extended on metapleuræ; mesopleuræ reticulate anteriorly, continuing as transverse rugæ to the speculum, which is glabrous; propleuræ reticulate above, with coarse, transverse rugæ below. 1st abdominal segment with lateral margins strongly carinate above and below, lower carina with two coarse, curved spines, the basal curved inwards, and a smaller spine produced below the spiracles; apical spine curved outwards. Abdominal tergites very densely reticulate-punctate, the basal half distinctly raised, 2nd tergite with a deep V-shaped impression at the base, width equals length, 3rd tergite twice as wide as long.

Length 14 mm. Ovipositor 5 mm.

♂.—Base of mandibles red, remainder of coloration

as in ♀ except that the hind coxæ are black with a fulvous fascia on the upper side. Upper part of the horse-shoe pattern of propodeum distinctly produced (less prominently in some ♀ specimens). Abdominal tergites with deep, transverse impressions in the middle; V-shaped impressions at the base of 2nd tergite, also in apical half of tergites 3-6. Spines of 1st segment present but less pronounced.

Length 14 mm.

Borneo, Sarawak, Mt. Matang, 3000 ft., 1 ♀, 1 ♂, 5. xii. 1913 (G. E. Bryant); W. Java, Palabœan, 1 ♀, xii. 1936 (F. Dupont), in Buitenzorg Museum, Java.

In *albispina* Cam. the head is entirely black, pronotum, tegulæ, mesopleural calli, scutellum, parapsidal spines and apophyses yellow; abdominal apical fasciæ reddish or yellow; remaining coloration as in *spinosa*. *Albispina* differs structurally from *spinosa* in the absence of pronotal calli.

I have not seen the types of *spiniacollis* Cam., 1909, and *acutispina* Cam., 1909, both from Borneo.

A very distinct genus by reason of the prominent curved spines of the scutellum.

My thanks are due to Mr. J. F. Perkins for much help in elucidating these genera.

III.—*Stray Notes on Mallophaga*.—III.

By G. H. E. HOPKINS, M.A.*

9. *The Identity of Lipeurus modestus* Giebel, 1874.

Harrison (1916) places *L. modestus* Giebel in the genus *Esthiopterum*, and *grandis* Piaget and *laculatus* Kellogg and Chapman as synonyms. Thompson (1936), following Harrison's lead, includes it in the genus *Perineus*. Both these authors have clearly overlooked the statement of Taschenberg (1882, p. 128), who, after examining the unique type, declares that it is nothing else but a female of *Lipeurus leucopygos* N., now known as *Ardeicola ardeæ* (Linn.).

* Published by permission of the Director of Medical Services, Uganda.

10. *The Identity of Lipeurus ætheronomus Nitzsch.*

Lipeurus ætheronomus was described (*ex* Nitzsch's manuscript) by Giebel in 1861 (p. 517). In 1874 (p. 207, pl. xvii. fig. 8) he described the type, which he states was no longer in condition for detailed description, and published Nitzsch's sketch. The immature specimen had meanwhile apparently been lost, and it may or may not have been conspecific. Taschenberg (1882, p. 108) considered *ætheronomus* to be identical with *L. quadrimaculatus* Piaget (1880, p. 298, pl. xxiv. fig. 8), or, rather, with the form which Piaget mentioned from *Rhea*, and which he subsequently described (1885, p. 54, pl. vi. fig. 2) as *L. asymmetricus*. Harrison (1916, p. 130) transferred *ætheronomus* to *Esthiopterum*, and Bedford (1931, p. 291) placed it in *Falcolipeurus*, which is only explicable on the assumption that he had not seen the published figure.

Taschenberg is so far correct that a single glance at the figure is sufficient to show that *ætheronomus* is a *Struthiolipeurus* and not a *Falcolipeurus*, but I have recently had the opportunity of examining specimens of *S. struthionis* (Gervais), of which *L. quadrimaculatus* Piaget is a synonym, and find that the shape of both the head and the thorax of these specimens agrees reasonably well with the figures of *ætheronomus* and *quadrimaculatus*, but not at all with those of *asymmetricus* Piaget.

I consider, therefore, that *L. ætheronomus* Nitzsch is a synonym of *Struthiolipeurus struthionis* (Gervais), which has nearly twenty years' priority. Nitzsch's sketch shows the general appearance of the insect rather better than Piaget's more detailed figure.

11. *The Identity of two Species of Trichodectes, s. l.*

Kéler and Bedford have recently cleared up much of the confusion hitherto existing with regard to the Trichodectidæ found on the weasel, *Mustela nivalis* Linn., the stoat, *M. erminea* Linn., and the marten, *Martes foina* (Erx.). For these, together with some other species, Kéler has erected the genus *Stachiella*. Most unfortunately this distinguished worker on Mallophaga does not wholly accept the International Rules of Nomenclature, and in particular he considers that the publication of a name as a *nomen nudum* gives it priority over a validly-described name of later date. For this reason he adopts in some

instances a nomenclature which is not in accordance with the Rules, though in the particular case with which I deal here I hope to show that the name he uses need not be changed.

Kéler applies the name *Stachiella retusa* to the species found on *Martes foina*, and attributes it to Nitzsch, 1818. Nitzsch did not describe the species, and the first description is that of Burmeister (1838, p. 436). Kéler states that Burmeister's description was from the wrong material and really applies to specimens from *Mustela nivalis*, and it must be admitted that the very brief description fits such material better than it fits specimens from *Martes foina*. If this were all it would undoubtedly be necessary to place *T. retusus* Burmeister as a synonym of *Stachiella mustelæ* (Schränk), and to rename *T. retusus* as later described and figured by Giebel (1861, p. 87, and 1874, p. 55, pl. iii. fig. 4) and by Kéler. But comparison of the description given by Burmeister with that published by Giebel in 1861 suggests very strongly that the former is not to be regarded as applying to different material but as a very careless and inaccurate description of the same material as was used by Giebel (*i. e.*, the material from *Martes* on which Nitzsch based his *nom. nud.*, *T. retusus*). This material is that used by Kéler for his excellent redescription and figure. There seems, therefore, to be no need to alter the name, and the species may stand as *Stachiella retusa* (Burmeister). It is particularly to be noted that *T. retusus* "N." of Piaget (1880, p. 387, pl. xxxi. fig. 8) is not this species but *mustelæ* (Schränk), and that most later users of the name *retusus* have misapplied it.

The position with regard to *Trichodectes dubius* Nitzsch is very different. In Harrison's Catalogue (1916) this name is referred to Nitzsch in Denny, Harrison taking the view that Nitzsch's publication of the name in 1818 was a *nomen nudum*. This view has been accepted by several later authors, but is quite incorrect. The original mention of the name by Nitzsch is in the following form :—

"Tr. (dubius) (*Mustelæ vulgaris*).

Pediculus *Mustelæ* Schränk Faun. boica."

The name *dubius* is, therefore, not a *nomen nudum* but an unnecessary *nomen novum* for *mustelæ* Schränk,

and an absolute synonym of this name—a view correctly accepted by Kéler. Both names apply to the species found on the weasel. In this connection it is necessary to consider also the name *Trichodectes pusillus* N. (Giebel, 1861, p. 88); this is again an unnecessary new name for *dubius* Nitzsch. Although Giebel, in 1874, mentions as hosts both *M. vulgaris* and *M. erminea*, he definitely states that he had seen no material from the latter host, which is evidently quoted from Denny. The name is an absolute synonym of *mustelæ*.

Denny's description of *T. dubius* was made from specimens collected from weasel and stoat, which he did not separate. His material has been lost, but Thompson (1937, p. 76) has designated *M. erminea* (stoat) as type-host, and Bedford (1939, p. 108, figs. 3, 4) has published a description and figures of material from the same host under the name *Trichodectes dubius* Nitzsch. It will be obvious from the facts set out above that *T. dubius* Denny (as restricted by Thompson and by Bedford) is invalidated by *T. dubius* Nitzsch, and requires a new name. I would have wished to name it in honour of my friend the late Mr. G. A. H. Bedford, who did so much to increase our knowledge of the Trichodectoidea, but his name has already been attached to several species of the group, and in view of the fact that at least one distinguished worker still regards all the species of Trichodectoidea as congeneric this course might lead to confusion.

I have been able to examine a large number of specimens of the species of *Stachiella* found on the stoat, including the material utilized by Bedford. Although my material is from two different subspecies of the host, and from a number of different localities in England and Germany, the differences which separate the species from *mustelæ* are absolutely constant throughout the series. These differences are excellently shown in Bedford's figures, and I see no object in re-figuring the species. My series shows a preponderance of females over males, but it is not very marked.

Stachiella ermineæ, sp. n., differs from *S. mustelæ* (Schränk) chiefly in details of chaetotaxy and in the form of the subgenital median lobe of the female. I have not seen *S. retusa* (Burmeister), but from Kéler's figure the chaetotaxy of this species is much more like that of *mustelæ* than that of *ermineæ*.

In the *female* the subgenital lobe in both species has a median excavation, bordered on each side by a projection; in *ermineæ* this projection is somewhat irregularly shaped and variable, but it is shorter and less slender than in *mustelæ*. The arrangement of the setæ is much the same in the two species, but their size and number differ considerably; almost all the tergo-lateral setæ of the abdomen are longer in *ermineæ* than the segment from which they arise, whereas in *mustelæ* they are distinctly shorter than the segment; they are also somewhat more numerous in *ermineæ*. The difference in size is especially marked on the second (apparent) tergite, which bears a minute seta in *mustelæ* but a large one in *ermineæ*. The sternocentral setæ of the two species differ in a similar way, being longer (especially towards the outer end of the row) in *ermineæ* than in *mustelæ*, though there appears to be little or no difference in the number of sternocentrals in the two species.

In the *male* both species possess two tergo-lateral setæ and one tergo-central seta on most of the abdominal tergites; in *mustelæ* the former are of roughly equal size and the latter are large (longer than, or about as long as, the segment) on the first to fifth apparent abdominal tergites, whereas in *ermineæ* the outer tergo-lateral seta of each pair is much smaller than the inner and the tergo-central setæ on all but the first two apparent tergites are minute. On the ventral surface the sternocentral setæ are more numerous and longer in *ermineæ* than in *mustelæ*.

Holotype female and allotype male from *Mustela erminea stabilis* Barrett-Hamilton (English stoat), from Suffolk, England, May 1935. Paratypes from same host (various English localities and dates) and from *M. erminea æstiva* Kerr, Aulendorf, Württemberg, Germany, and Rosenheim, Bavaria, Germany. Holotype and allotype presented to the British Museum; paratypes in the Bedford, Eichler, Hopkins, Radford, and Thompson collections.

It must be noted that *Trichodectes* "*retusus* Nitzsch" of Osborn does not resemble *S. ermineæ*. His specimens were figured by Morse (1903, p. 623), and are stated to have been taken "on the weasel, *Putorius ermineus*," at Ames, Iowa. *Mustela erminea* does not occur in North America, and from Morse's figures one can only assume either

that the North American representative of the stoat (probably *M. cicognani*) has a totally different parasite from the European stoat or that the specimens were not from the host ascribed to them.

12. *The Identity of Lipeurus fissomaculatus* Giebel.

Giebel described this species somewhat briefly in 1874 (p. 225) from a few specimens collected on *Mycteria crumenifera* without further data. Piaget (1880, p. 317) makes two erroneous statements about it: that the principal difference from *versicolor* Nitzsch (= *ciconiæ* Linn.) is in the shape of the abdominal bands (*i. e.*, the chitinized tergal areas) and that this shape was due to the immaturity of Giebel's material; Giebel mentioned two characters of greater importance than the shape of the bands, and this shape is characteristic of adult specimens of the species found on *Leptoptilos crumeniferus*. Taschenberg (1882, p. 128) noted that the types were no longer in the Halle collection, and considered the species to be synonymous with *versicolor*. Piaget (1885, p. 58, pl. vi. fig. 5) obtained the species on *Leptoptilos crumenifer* in the Amsterdam Zoo and described it as *Lipeurus genitalis*; his figure, though adequate for the recognition of the species, is not wholly accurate (see below). Harrison (1916, p. 134) accepted Taschenberg's statement that *fissomaculatus* = *versicolor*, and included both the names under discussion in *Esthiopterum*—*fissomaculatus* as a synonym of *ciconiæ* and *genitalis* as a good species. Clay (1935, p. 616) included *genitalis* in her new genus *Ardeicola*.

But Giebel states of his species that the process of the third antennal segment in the male is markedly longer than in *L. maculatus* (with which he compares it), that the clypeal signature is not round but narrowly parallel-sided and long, and that "zeigen die Flecken und Binden der Hinterleibssegmente an ihrem Vorderrande und nahe dem Seitenrande der Segmente einen tiefen scharf umgränzten weissen Schlitz." All these characters are found in *genitalis* but not in *ciconiæ*. It is, therefore, beyond reasonable doubt that *genitalis* Piaget is a synonym of *Ardeicola fissomaculata* (Giebel).

As Giebel's types are lost I designate as neotype a male and as neallotype a female from a marabout stork,

Leptoptilos crumeniferus (Lesson), shot by myself at Bombo, Buganda Province, Uganda, on 8th March, 1934; I have presented these neotypes to the Halle collection *. Many neoparatypes from the same host (various localities in Uganda) are in my own and other collections.

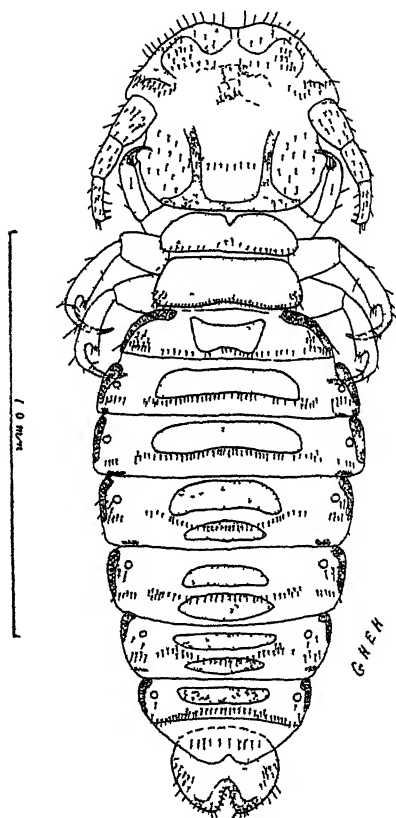
I noted above that Piaget's figure is not wholly accurate. He shows the third segment of the antenna as having a rod-like process, which I was unable to find in any of my specimens. Miss Clay has kindly examined Piaget's types at my request, and finds that there is no such rod-like process but "a short blunt projection, thickened distally"; this agrees perfectly with my material. In addition, Piaget figures the abdomen as almost parallel-sided, whereas in fresh specimens the sides are very distinctly convex; it is probable that Piaget's specimens had shrunk somewhat before he described them, for the shape of abdomen which he figures is to be found in some of my specimens which had been in a tube in which the alcohol had dried up, and also in a few which were distorted during dehydration, but not in specimens freshly removed from the host.

13. *Bovicola chorleyi*, sp. n.

This species is of the same general appearance as *B. harrisoni* (Cummings), *B. martinaglia* Bedf., and *B. hilli* Bedf., though the last-named is much more heavily sclerotized. From both *harrisoni* and *martinaglia* the male of the new species is exceedingly easily distinguished by the shape of the bifid apex of the abdomen, and the female by the shape of the head and other details. The peculiar apex of the male abdomen is obviously a development of the condition found in *harrisoni* and (to a less degree) in *martinaglia*; a very similar condition is found in *Damalinia* (especially in the undescribed male of *D. theileri* Bedf.), and the bifid projection appears to be the produced sternite of the last segment. This group of species seem to me to be slightly intermediate towards *Damalinia*, and I have some doubt as to whether the two genera are really distinct.

* These specimens were sent to Dr. Kéler a short time before the invasion of Poland, and it is improbable that they reached him. I am presenting a second pair to the British Museum as substitutes should the original neotypes prove to be lost.

Male.—Head broader than long, forehead fairly deeply concave anteriorly. Chætotaxy of head as shown in the figure. First segment of antenna much enlarged, second segment very slightly shorter than third, apex of antenna with two short, stout, curved spines, as is usual



Bovicola chorleyi, sp. n., male.

in the genus. Dorsum of prothorax with an oblique row of small setæ, of pterothorax with a continuous nearly straight row of small setæ extending the whole breadth of the segment just before the posterior margin. Legs moderately stout, the tibiæ of the second pair slightly slenderer than the others. Abdomen pale-coloured, with

rather weakly chitinized tergal plates and pleurites. Abdomen broadest at the second (apparent) segment, thence tapering regularly to the apex, margins strongly crenulated. Tergite of first segment somewhat quadrate, weakly concave anteriorly and posteriorly and broader anteriorly than posteriorly, remaining tergites convex anteriorly and concave posteriorly; subsidiary tergal plates present posterior to the tergites of the 4th, 5th, and 6th (apparent) segments. Each segment with a single continuous transverse row of small setæ and a group of pleural setæ, the latter practically continuous with the transverse row on the posterior segments. Apex of abdomen produced into a large lobe, deeply incised terminally in the middle, shaped as in the figure; the lobe is pale brown, but the incision has a rather broad border which is deeper brown owing to its higher degree of chitinization; it is provided with a marginal row of small setæ which extends into the incision and anteriorly becomes irregular and submarginal. Genitalia of the same type as in *harrisoni*, but very different in proportions and shape of the parts, the basal plate broad and short, the parameres very strongly curved, and the endomeres short, slightly curved, and rather slender.

Female.—Head almost as in the male except for the usual sexual difference in the antenna. Abdomen broadest at the 3rd (apparent) segment, almost perfectly egg-shaped, margins crenulated as in the male. Tergite of 1st segment shaped almost as in male but broader and deeper, tergites of segments 2 to 7 with almost parallel margins and rounded ends, slightly convex in front and concave behind, the tergite of segment 2 very slightly narrower (from side to side) than that of segment 3, which is the broadest, the remainder decreasing regularly in breadth from the tergite of segment 3 to that of segment 7, tergite of 8th segment irregularly shaped, much reduced posteriorly, so that it is almost completely broken in the median line. Chætotaxy of abdomen almost exactly as in male. Copulatory valves* of approximately the same shape as in *B. thompsoni* Bedford, but setiferous margin convex posteriorly and concave anteriorly, forming a double curve.

* I adopt a translation of Kéler's term for the gonapophyses of other authors.

Measurements, in millimetres, are as follows :—

	Male.		Female.	
	Length.	Width.	Length.	Width.
Head.....	0.45	0.54	0.45	0.47
Prothorax ...	0.10	0.34	0.10	0.35
Pterothorax .	0.10	0.37	0.10	0.41
Abdomen ...	1.21	0.67	1.06	0.76
Total ...	1.86		1.71	

Described from 8 males and 16 females from *Alcelaphus leluwel roosevelti* (Heller), collected by Mr. T. W. Chorley at Potango, Awach, Gulu District, Uganda, on 10th November, 1937. It is worth recording that Mr. Chorley and I, being very largely dependent on this buck for meat during most of 1937, must have examined more than 20 specimens for *Mallophaga*; *B. chorleyi* was only found on the single individual mentioned above.

Holotype male and allotype female presented to the British Museum; paratypes in the Bedford, Hopkins, and other collections.

14. *The Species of Mallophaga described by Rudow from Tinamidæ.*

Carriker (1936) and Clay (1937) have demonstrated very clearly the extreme complexity of the Mallophagan fauna of the Tinamidæ. Conditions in this group are nearly perfect for the carelessness of Rudow, coupled with rash identifications of his species by later authors, to produce the maximum confusion in the synonymy, and the result has been almost all that could have been expected.

Rudow appears to have collected material off only two species of Tinamous, *Nothura boraquira* ("*Tinnamus bannaquira*") and *Rhynchotus rufescens* ("*Tinnamus rufescens*"). From the former he described *Trinoton biguttatum* (1866, p. 467), *Goniocotes dilatatus* (1870, p. 479), *Docophorus crassipes* (sic) (1869, p. 16), *Nirmus ansatus* (1870, p. 474), and *N. tinnami* (1870, p. 473). From *R. rufescens* he described *Goniocotes rotundatus* (1869, p. 22) and *Nirmus crassiceps* (1870, p. 473). Knowing how specific the Mallophaga of the Tinamidæ

are, we dare not synonymize species from two hosts which are not even congeneric, though this has been freely done in the past.

It is probably simplest to consider the species according to the genera in which Rudow placed them :—

No conclusion is possible with regard to *Trinoton biguttatum*, but there is a strong probability that the specimens were stragglers. It is conceivable that there is on the Tinamidæ an Amblycerous genus superficially resembling *Trinoton*, but no subsequent author has rediscovered it.

Goniocotes rotundatus and *G. dilatatus* have caused endless trouble. The very brief description of the former was reproduced by Taschenberg (1882, p. 94); Giebel seems not to have known this description. The original description of this species agrees very well with Carriker's interpretation of the name (1936, p. 159, pl. xxviii. fig. 1), except that there are actually six "roten stirnpunkten" instead of four as stated by Rudow, and the latter describes the apex of the abdomen as "2-höckrig" or two-humped. The outer pair of "stirnpunkten" are very small and easily overlooked, and the abdomen of the female is apically somewhat indistinctly bilobed*, so that these discrepancies are of no importance. The size is another discrepancy, for Rudow says that the "Grösse" of *rotundatus* (by which he seems to mean the length) is 1 mm., whereas Carriker's specimens are markedly larger; but I have shown (Hopkins, 1939) that the sizes given by Rudow are completely meaningless. There is, therefore, absolutely nothing in the original description of *Goniocotes rotundatus* which conflicts with Carriker's interpretation of the name. Giebel seems not to have known the species, and Piaget's mention of it (1880, p. 233) is quoted from Rudow. Taschenberg (1882, p. 92, pl. iii. fig. 8) redescribed it and figured the male; the specimens he used were part of Rudow's material and are still preserved in the Halle collection, and it would have been unnecessary to discuss the species at such length but for Taschenberg's amazing statements about it in his discussion of *dilatatus*. Taschenberg's figure is fairly good, and the species figured has been

* Through the kindness of Mr. Carriker I possess a pair of his specimens from *R. rufescens rufescens*.

accepted by all later authors (correctly, in my opinion) as *Goniocotes rotundatus* Rudow.

In his description of *Goniocotes dilatatus* (1870, p. 480) Rudow states that specimens from *Rhynchotus rufescens* "sind mit diesem in der Form übereinstimmend, nur das Abdominalende ist etwas breiter, die Zeichnungen etwas länger und daneben mit gelbem Fleck. Da aber der Thorax als charakteristisches Merkmal bei beidem gleich ist, auch das Abdomen und der Kopf nur in der Breite etwas abweichen, so nehme ich keinen Anstand, sie beide zu einer Species zu rechnen." These remarks are at the root of much of the confusion with regard to the names *rotundatus* and *dilatatus*, for they have been construed as a statement that *rotundatus* (from *R. rufescens*) is conspecific with *dilatatus*. They cannot rightly be read thus, for Rudow does not mention the name *rotundatus* in this connection; but even if it be assumed that this was his meaning, the differences he mentions would certainly nowadays be considered specific. The original host of *Goniocotes dilatatus* was "*Tinnamus bannaquira*," and Giebel (1874, p. 192) redescribed as *Goniodes dilatatus* Rudow specimens from "*Tinamus bannaquivira*," which he states he received from Rudow; he describes the antennæ as strongly sexually dimorphic, and for this reason it has been assumed that his species is not the same as that of Rudow. Piaget (1880, p. 258, pl. xxi. fig. 5) described and figured a species from *Tinamus variegatus* and *T. obsoletus* which he called *Goniodes dilatatus* R.; Clay (1937, p. 139) has examined Piaget's material, and finds that it is *Heptapsogaster subdilatatus* (Piaget). Taschenberg's treatment of *dilatatus* is truly amazing. He starts out (1882, p. 48) with the misstatement that Rudow described the species from *Rhynchotus rufescens*, and then states that Rudow apparently had two totally different species but identified them wrongly: "Was er als *Goniocotes dilatatus* beschrieben hat, ist wirklich ein *Goniocotes* und kein *Goniodes*, was er aber an Giebel angesandt hat, ist kein *Goniocotes* sondern ein *Goniodes*." He identified the latter (incorrectly) with *dilatatus* Piaget, and states (also correctly) that as *dilatatus* Rudow and *dilatatus* Giebel are in different genera both names can be used *. He says that one of the

* In spite of the fact that, according to him, *dilatatus* Giebel is a misidentification of *dilatatus* Rudow.

two slides from Hamburg (i. e., from Rudow) contains two females of the species described by Giebel and the other contains two males of the *Goniocotes* and one of the *Goniodes* *. His most important statements are that he had seen Rudow's drawing of *dilatatus*, and that all the material he had seen was from *R. rufescens*. He goes on to state (p. 49) that, from the description, *rotundatus* Rudow is identical with *dilatatus* Rudow, which is certainly incorrect. As he had seen Rudow's drawing we may safely assume that *dilatatus* Rudow is very similar to *rotundatus*, as is, indeed, apparent from Rudow's descriptions of the species. But it seems perfectly clear from Taschenberg's own statements that he never saw true *dilatatus*, since he saw no material from *Nothura boraquira*; his sinking of *dilatatus* Rudow to *rotundatus* is, therefore, wholly unjustified. Carriker (1936, p. 126) has accepted Taschenberg's statements about *dilatatus*. But is there any evidence for Taschenberg's statement that *dilatatus* Giebel is not *dilatatus* Rudow? I have compared the descriptions of the two authors very carefully and can find only the following major discrepancies between them:—Giebel describes the antennæ as sexually dimorphic, whereas Rudow placed the species in *Goniocotes*. Rudow states that the metathorax is much wider than the head, whereas Giebel merely says that it is broad, and Rudow says that the angles of the abdomen project, whereas Giebel says that they are not prominent. Both descriptions obviously refer to members of the genera *Heptapsogaster* or *Tinamicola*, which are only separated by the presence of sexual dimorphism of the antenna in the former. I do not consider any of the discrepancies which I have mentioned to be important, especially in view of Rudow's notorious carelessness. With regard to the antennæ, Rudow's description is quite clearly of the female, and there is no evidence that he ever examined a male, though he obviously sent males to Giebel. The statement about the metathorax must be a slip, for of no known member of either of the genera is this true, but in *Tinamicola rotundata* the wings of the mesothorax, to which both Rudow and Giebel clearly refer in this connection, make it appear quite distinctly wider than the

* If this statement is correct the specimens must be lost, for Dr. Kéler kindly informs me that all the specimens now in the collection agree with Taschenberg's figure.

head, and the difference between "wider" and "much wider" is a mere matter of personal opinion in the absence of measurements or figures. Similarly the third discrepancy is a matter of personal opinion, for the two species figured by Carriker in his pl. xvi. fig. 2, and pl. xxviii. fig. 1, would certainly be described as having projecting angles by some authors but not by others. I claim, therefore, that there is no real reason to assume that Giebel's *dilatatus* was not that of Rudow, and that the fact that Giebel states that his material was from the type-host and was received from Rudow is good evidence that it was Rudow's species. In any case Giebel's position as first reviser entitles his interpretation of the name to stand unless there is conclusive evidence that he was wrong, and the evidence against him is very far from conclusive. Rudow's description is not sufficiently detailed to be referable to any particular species, and his types are lost. Giebel's much more careful and detailed description does not conflict in any important respect with Rudow's, and (Giebel's material also being lost) the name *dilatatus* Rudow is applicable to any species of *Heptapsogaster* occurring on *Nothura boraquira* which agrees with Giebel's description. It should be fixed by re-description and the erection of a neotype*.

Docophorus crassipes is obviously a misprint for *crassipes*, since one of Rudow's characters for the species is "Füsse dick." The description reads rather like that of a *Heptarthrogaster*, but so many genera are known from the Tinamidæ that it would be rash to attempt to place the species, even generically, until ample material is available from the type-host, *Nothura boraquira*. In any case the name is invalidated by *Docophorus crassipes* Burmeister, 1838.

The two names *Nirmus ansatus* and *N. tinnami* were both given to material from *Nothura boraquira*, and Carriker (1936, p. 93) considers that they refer to the two sexes of a species of *Strongylocotes*. I see no reason to disagree with this opinion. He also (p. 92) synonymizes *Nirmus crassiceps* Rudow with *Strongylocotes l. lipogonus* (Nitzsch).

* Miss Clay kindly informs me that she has both sexes of a *Heptapsogaster* from *N. boraquira* which agrees with Giebel's description, and that she hopes to redescribe the species.

both from *Rhynchotus rufescens*, and I believe him to be correct.

SUMMARY.

Great confusion has occurred with regard to some of the Mallophaga described by Rudow from Tinamidæ, the principal causes being the inadequacy and carelessness of his descriptions, the fact that most of his types are lost, and Taschenberg's errors with regard to hosts and identifications. The statements made by Taschenberg have been accepted by almost all recent authors, but many of them are entirely erroneous. Of the species described by Rudow *Trinoton biguttatum*, from *Nothura boraquira*, is not identifiable even generically, and is probably a straggler; *Docophorus crassipes*, from the same host, is perhaps a *Heptarthrogaster*, but the name is preoccupied by *D. crassipes* Burmeister.

There is no valid reason for the assumption that *Gonicotes dilatatus* Rudow and *Goniodes dilatatus* Rudow of Giebel are not conspecific; the assumption originates with Taschenberg, who never saw material of either, since he records that all the material he saw was from *Rhynchotus rufescens*. The name *Heptapsogaster dilatatus* (Rudow) is, therefore, available for any species of this genus, found on *Nothura boraquira*, which agrees with Giebel's redescription. Piaget's "*dilatatus* Rudow" is not Rudow's species, but is identical with *Heptapsogaster subdilatatus* (Piaget).

Gonicotes rotundatus Rudow has been correctly identified by Taschenberg and by Carriker. It is a *Tinamicola*, and is only known from *Rhynchotus rufescens*. Some of Rudow's type-material is in the Halle Museum, and from this material a lectotype ought to be selected.

Nirmus ansatus and *N. tinnami*, from *Nothura boraquira*, are the sexes of one species of *Strongylocotes*; the latter name has page-priority. *Nirmus crassiceps* is a synonym of *Strongylocotes l. lipogonus* (Nitzsch).

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IV.—*Resultate der Oxford Universität Expedition nach Sarawak (Borneo), 1932.—Beitrag zur Kenntnis der Psammochariden-Fauna.* Von H. HAUPT, Halle (Saale).

Mit wenigen Ausnahmen wurden die hier behandelten Arten von den Herren Dr. B. M. Hobby und A. W. Moore erbeutet während der Oxford Universitäts-Expedition im Jahre 1932, und zwar in der Umgebung von Sarawak. Bei den meisten der Arten handelt es sich um Endemismen; nur wenige Arten haben eine weitere Verbreitung und wurden schon ausserhalb Borneos gefunden.

Sämtliche Typen befinden sich im British Museum.

PEPSINÆ.

HEMPEPSIS Dhlb.

Von den zahlreichen Vertretern dieser Gattung wurden mir allein aus der orientalischen Region 27 Arten mit goldgelben Flügeln bekannt. Unter diesen gibt es eine Gruppe, bei der Propodeum und Abdomen \pm schwarz gefärbt sind, das Propodeum von \pm dichter goldener Pubeszenz bedeckt ist, wo aber der übrige Thorax-Rücken und der Kopf gelbbraun gefärbt sind unter dichter goldener Pubeszenz. In diese Gruppe gehören beide hier behandelten Arten.

Hemipepsis approximata, sp. n.

♀. 23–27 mm. Schwarz sind: Abdomen und Propodeum, ausserdem Seiten und Unterseite des Thorax mit den Hüften. Rotgelb sind die Fühler, die Mundteile, Kopf und Thorax-Rücken, die Beine von den Hüften an, die Hüften \pm an ihren Enden sowie die Spitze des Abdomens; letztere dunkel-rostrot behaart. Kopf und Thorax-Rücken sind dicht dunkel-golden pubeszent, die schwarzen Teile des Thorax mit den Hüften sowie das Propodeum sind fein golden pubeszent überhaucht. Gelegentlich ist am Propodeum vorn in der Mitte oder am Hinterrande Rotfärbung vorhanden, und an der Basis des 2. Abdominal-Tergits kann beiderseits je ein rötlicher Fleck auftreten.

Flügel heller bis dunkler goldgelb, ohne dunkleren Saum. Das auffallendste Merkmal im Vorderflügel ist die Makelbildung in der 2. Medialzelle: An der hellen Makel liegen 2 dunkle Flecken, und zwar ein gestreckter Fleck im vorderen oberen Winkel der Zelle, ein proximal gerundeter Fleck etwa in der Mitte der Zelle. Die vor der Makel liegende Strecke der Media ist sehr flach und gleichmässig \sim förmig geschwungen.

Kopf hinter den Augen sehr stark verschmälert, Schläfen flach abgewölbt, seitlich nicht $\frac{1}{2}$ so dick wie ein Auge. Ocellenstellung spitzwinklig, POL=OOL. Seiten der Stirn eben (gegen die Mittellinie weder gehoben noch gesenkt), ihr mittlerer Teil eine breite und flache Furche bildend, die sich gegen die vordere Ocelle verschmälert. Innenränder der Augen ziemlich gerade, nach oben stark konvergent, ein Auge mitten breiter als eine Stirnhälfte. 3. Fühlerglied deutlich länger als Schaft + Pedicellus. Clypeus breit, vorn flachbogig abgerundet und hier deutlich länger als ein Seitenrand.

Pronotum flachbogig ausgerandet. Scutellum höchstens vorn mit Andeutung einer kielartigen Mittellinie; Postscutellum vorn mit Andeutung eines flachen Gipfels. Postnotum fast so lang wie das Postscutellum, mit nach vorn durchgebogenen Querrunzeln, die von dem seitlichen Grübchen aus (an der Grenze des Propodeums vor dem Stigma!) steil ansteigen; mitten sind diese Runzeln oder Streifen durch flachen Längseindruck niedergedrückt, aber nicht durchschnitten. Propodeum mit durchlaufender scharfer Querleiste vor dem abschüssigen

Teil und mit sehr flachen Infrastigmal-Tuberkeln; sein horizontaler Teil mit feinen Querrunzeln (16–19), sein abschüssiger Teil nur oben kräftig gerunzelt, an den Seiten weniger deutlich; die Runzeln ausserhalb des Stigmas laufen diesem parallel und setzen sich fort (über das Grübchen hinweg!) in den Runzeln des Postnotums; die mittlere Längsfurche auf dem Propodeum ist nur angedeutet.

♂. 16–18 mm. In der Färbung mit dem ♀ übereinstimmend, nur erscheint das Abdomen \pm braunrot infolge einer filzartigen Pubeszenz auf dem 2. und 3. Tergit.

Entscheidend für die Zugehörigkeit als ♂ zum *approximata* ♀ ist die Form des Hinterkopfes, der Verlauf der Querrunzeln auf der Mitte des Postnotums und die Gruppierung der Flecken in der Makel-Bildung der 2. Medialzelle.

Propodeum stark behaart, mit flacher Wölbung nach rückwärts abfallend, fast durchgehend quer-gerunzelt, ohne abgegrenzten abschüssigen Teil; die Runzeln ausserhalb des Stigmas laufen diesem nicht parallel, sondern sind deutlich quer gerichtet und setzen sich nicht fort in den Runzeln des Postnotums.

Die Genitalplatte ist breit, flach gewölbt, parallelseitig, am Ende flachbögig abgerundet, behaart.

Mir lagen vor 3 ♀♀ 2 ♂♂ von Sarawak, erbeutet am Fusse des Mt. Dulit an der Vereinigung der beiden Flüsse Tinjar und Lejok, 17. ix. 1932. Ausserdem lagen mir noch vor aus älteren Fängen 2 ♂♂ von Sandakan und ein weiteres ♂ von Sarawak.

1 ♀ von 23 mm Länge liegt mir vor von Singapore (leg. H. N. Ridley), das morphologisch nicht völlig übereinstimmt mit den ♀♀ von Borneo. (1.) Der Vorderrand des Clypeus ist nicht flachbögig abgerundet, auch nicht gerade, sondern mitten sogar ein wenig eingezogen, im ganzen sehr flach stumpfwinklig ausgeschnitten. (2.) Die Ausrandung des Pronotums ist mehr stumpfwinklig als bogenförmig.

Da mir nur dies eine Stück vorliegt, verzichte ich darauf, trotz der festgestellten Abweichungen, eine Benennung vorzunehmen, vielleicht als geographische Form. Auf jeden Fall ist aber das gleichzeitige festländische und insulare Vorkommen der Art bemerkenswert.

Hemipepsis lacæna Sm.

Es ist leicht möglich, dass das mir vorliegende ♀ nicht mit der wohl noch vorhandenen Type übereinstimmt, die auf Amboina erbeutet wurde. Ich hatte aber in meine noch ungedruckte Tabelle der Arten mit goldgelben Flügeln unter obigem Namen schon ein ♂ von Lombok aufgenommen, das ich für die Art hielt, und das mir jetzt vorliegende ♀ passt gut zu dem ♂. Die Diagnose, die Smith von seiner Art gibt (Journ. Proc. Linn. Soc. Zool. v. 1861, p. 121, n. 4, ♀), ist sehr kurz, und ausser der Grössen-Angabe (8 lin.) nennt nur ein Satz etwas, was die Art vor zahlreichen ähnlichen Arten auszeichnen könnte: "The coxæ ferruginous at their apex beneath."

Auf Grund jener beiden Anhaltspunkte hielt ich jenes vorerwähnte ♂ trotz des anderen Fundortes für *H. lacæna*. Als besondere Eigentümlichkeit besitzt dieses ♂ ferner einen schwarzen Scheitelfleck, auf dem die Ocellen stehen, von dem aber Smith nichts erwähnt. Bei dem ♀ von Borneo ist dieser Fleck zu einem Querstreifen ausgedehnt.

♀. 20 mm. Kopf hinter den Augen stark verschmälert, Schläfen flach abgewölbt; Stirn gegen die Mitte nicht eingedrückt, querüber gerade, eben (bei Ansicht von oben!), mit eingepprägter Mittellinie; Fühlersockel deutlich vortretend. Clypeus vorn gerade, sein Vorderrand so lang wie einer der Seitenränder. Scutellum und Postscutellum flach gewölbt, mit dem vorderen Propodeum in einer Ebene liegend. Postnotum nur wenig eingesenkt, so lang wie das Postscutellum, mit sehr feinen Querrunzeln, die durchlaufend gerade zur Seite ziehen. Propodeum fein querrunzlig, zum abschüssigen Teil abgewölbt, vorderer und abschüssiger Teil an der Abwölbung ohne durchlaufende Grenzkante; die Runzeln ausserhalb des Stigmas sind ebenfalls quer gerichtet und laufen auf das Stigma zu.

Färbung vorwiegend schwarz; dunkel-golden pubescent sind: Stirn und Clypeus, ein breiter Saum des Pronotums, der mittlere Teil des Scutums sowie die Spitze des Abdomens. Fühler und Beine ockerfarben, Hüften (Coxen) unterseits und gegen ihr Ende ockerfarben und ± golden pubescent. Rostrot sind: Schläfen, Scutellum, Postscutellum und die Mitte des Postnotums.

Die Ocellen stehen auf einem schwarzen Quersfleck zwischen den Augen.

Flügel gelb-hyalin, ihr Spitzensaum leicht angeraucht ; 2. Medialzelle ohne Makel, nur mit einem etwas glasigen schmalen Längsfleck in der Mitte.

Fundort : Sandakan (Borneo).

LEPTODIALEPIS Hpt. 1929.

T.g. *Salix nicevillei* Bingh. (Treubia, x. 1929, p. 465).

Hinterschienen ♀ mit zahlreichen (16–20) schmalen Schuppenspornen und einer beginnenden 2. Reihe kleinerer Schuppenzähne (aussen) nahe dem Knie. Klauen ♀ mit Zahn, beim ♂ gespalten.

Im Vorderflügel ist die Subcostalzelle durch den flach ansteigenden 4. Abschnitt des *R* spitz geschlossen. 3. Radialzelle vorn niemals länger als die 2., etwa ebenso lang, meist aber deutlich kürzer.

Innenränder der Augen bis über ihre Mitte parallel, von da an gegen den Scheitel stark konvergent ; ein Auge mitten so breit wie eine Stirnhälfte.

Diese Gattung ist weder nach morphologischen Merkmalen noch nach Färbung und Zeichnung vollkommen einheitlich (wie z.B. auch *Cryptochilus* Pnz.). Bei vielen der ♀♀ ist der Clypeus vorn stumpf dreizählig, bei den zugehörigen ♂♂ vorn gerade oder bogig ausgerandet. Das Postscutellum ♀ ist \pm komprimiert (mit oder ohne deutlichen Längsgrat), beim ♂ \pm pyramidal, im letzteren Falle dann auch das Scutellum nach rückwärts deutlich verschmälert, seitlich fast dachartig abfallend und oft mit deutlichem Kiel. Propodeum stets \pm deutlich quer gerunzelt, mit oder ohne Stigmen-Längsfurche, mit oder ohne Infrastigmal-Tuberkeln ; manche Arten besitzen ein kugelig abgewölbtes Propodeum. Das Pronotum besitzt bei allen Arten leichtgewölbte Schultern.

Bei einer der Artengruppen ist das Pronotum \pm gelb gerandet, und dann ist als weiteres Färbungs-Element noch eine Fleckenreihe vorhanden : ein Fleck auf dem Scutum vor dessen Hinterrand (das Scutellum berührend), ein Fleck auf dem Scutellum und einer auf dem Postscutellum. Diese Flecken haben hellere oder dunklere gelbe Färbung, sind schmal oder breit, \pm deutlich viereckig.

Mittelgrosse bis grosse Arten.

Verbreitung: Ganze orientalische Region bis Neu-Guinea.

Vergleich zwischen *L. javanus* Lep. und
L. dentatus, sp. n.

Hinterrand des Pronotums gelb, und ausserdem die Reihe der drei gelben Flecke auf dem Thorax-Rücken vorhanden. Flügel \pm gelb und mit schmalem dunklerem Randsaum. Clypeus \varnothing vorn \pm deutlich dreizählig (der Randsaum beiderseits der Mitte flachbögig ausgerandet); beim σ ist der Clypeus vorn gerade oder ausgerandet. Hinterkopf \varnothing etwa cylindrisch, gegen die Augen zurücktretend, die Schläfen hoch gewölbt und fast aufgetrieben. Untergesicht bis zu den Fühlern schwarz. Propodeum mehr netzartig als quer gerunzelt..... 1.

1. Flügel ($\varnothing\sigma$) goldgelb, beim \varnothing sehr schmal schwärzlich gesäumt. Fleckenreihe $\varnothing\sigma$ dunkelgelb. Schwarze Färbung des Scheitels hinter den Ocellen unscharf begrenzt; dunkel und ebenfalls verschwommen begrenzt ist der gelbe Fleck auf dem Scutum.

σ . Flügel breiter gesäumt als beim \varnothing , der Saum aber unscharf begrenzt. Kopf mit sehr flach gewölbten Schläfen; Clypeus vorn gerade; schwarze Färbung des Scheitels über die Stirn hinweg bis zur Basis der Fühler verlängert, Untergesicht und innere Orbiten gelb. Vorletztes Sternit flach, kahl, stumpfwinklig ausgerandet; Genitalplatte ziemlich flach, gegen ihr Ende rundlich verschmälert, am Endrand winklig ausgeschnitten, der Rand mit langen gebogenen Borsten besetzt.— \varnothing 18–25 mm., σ 15–17 mm.—

1. *javanus* Lep.

Java (Philippinen?, Palawan?, Sikkim?). Flügel nicht absolut goldgelb; schwarze Färbung des Scheitels hinter den Ocellen scharf begrenzt, ebenso der quadratische Fleck auf dem Scutum scharf begrenzt. Schläfen σ ziemlich dick; Clypeus deutlich ausgeschnitten..... 2.

2. Flügel $\varnothing\sigma$ trüb grünlich-gelb, kaum merklich dunkler gesäumt.

σ . Die schwarze Färbung des Scheitels reicht etwas über die Ocellen hinaus und ist vorn zackig begrenzt; das ganze übrige Gesicht ist gelb. Ocellenstellung rechtwinklig. Clypeus fast trapezisch ausgeschnitten, so dass die Seitenecken seines Vorderrandes zahnartig hervortreten.—Vorletztes Sternit flach gewölbt,

dicht mit langen schwarzen Haaren bedeckt; Genitalplatte rundlich zugespitzt, mitten abgeflacht in Form eines Dreiecks, die Seiten eingewölbt, der Rand mit langen Haaren besetzt.

♀ 20–22 mm., ♂ 16–18 mm.—Borneo (Sarawak).

Holotypus ♀ und Allotypus ♂ im British Museum, London. Erbeutet wurden 5 Tiere an bzw. auf dem Mt. Dulit während der Oxford Univ.-Exped. 1932: 1 ♀ auf verwildertem ehemaligem Kulturland, 1 ♀ im Urwald, 2 ♂♂ im Moos- (Sumpf-) Wald in 4000 Fuss Höhe. 1 ♀♂ in meiner Sammlung 2. *dentatus*, sp. n.

Leptodialepis sericosoma Sm.

1 ♀ 4 ♂♂ Sarawak, am Fusse des Mt. Dulit am Zusammenfluss von Tinjar und Lejok in altem Sekundär-Wald 4. viii.–16. ix. 32 oder im Urwald. 1 ♂ am 7. viii. im Hause am Licht.

PLATYDIALEPIS, gen. nov.

T.g. *Salix junctellus* Cam. (Ann. & Mag. nat. Hist. x. 1902, p. 79, ♀♂, Assam).

Hinterschienen ♀ mit wenigen (8–10) breiten Schuppenzähnen. Klauen (♀♂) mit einem Zahn, beim ♀ aber auch zuweilen mit 2 oder 3 Zähnen. Klauenkamm kurz.

Im Vorderflügel ist die Subcostalzelle durch den flach ansteigenden 4. Abschnitt des *R* spitz geschlossen; dieser 4. Abschnitt liegt fast in derselben Richtung wie der 3. Abschnitt. Die 2. Radialquerader ist \pm deutlich distal durchgebogen.

Augen breit, ein Auge breiter als eine Stirnhälfte; Ocellen weit abstehend von den Augen. Stirn flach; Clypeus (wenigstens beim ♀) zu beiden Seiten der Mitte \pm deutlich flachbögig ausgeschnitten. Fühler schlank und langgliedrig. Pronotum an den Schultern mehr abgerundet als aufgetrieben. Scutum mit aufgekanteten schmalen Säumen ausserhalb der Parapsidenfurchen. Scutellum breit und flach, gegen seine Mitte leicht gehoben; Postscutellum ebenfalls breit und flach. Postnotum etwa so lang wie das Postscutellum, mit kaum merklichen feinen Querrunzeln oder völlig glatt. Propodeum mit steilerer (♀) oder flacherer (♂) Wölbung nach hinten abfallend, \pm kugelig gewölbt, ohne jede Skulptur und ohne Infrastigmatal-Tuberkeln.

Die mir bis jetzt bekannt gewordenen 8 Arten sind von mittlerer Grösse und besitzen einen sehr wenig skulptierten Körper, den aber eine dichte Pubeszenz (golden oder silbern) \pm völlig überzieht.

Verbreitung: Hinterindien, Formosa, Inselindien.

Platydialepis hobbyi, sp. n.

♀.—Länge 15 mm. Schwarz; golden pubeszent; Unterseite der Hinterschenkel mit gelbem Fleck. Die goldene Pubeszenz erstreckt sich über den ganzen Körper mit den Beinen, ist aber nur dicht und auffallend auf Stirn, Clypeus und Schläfen, Hinterrand und Seiten des Pronotums, Propodeum, Seiten des Thorax und auf den Hüften; alle übrigen Körperteile sind \pm fein pubeszent und schimmern je nach Beleuchtung golden. Behaarung auf Kopf, Thorax-Rücken und Bauchseite des Abdomens lang und sehr zerstreut.

Flügel gelblich-hyalin, im auffallenden Lichte leicht gebräunt erscheinend; Spitze der Vorderflügel leicht angeraucht.

Kopf nach rückwärts stark verschmälert, der Wölbung der Augen folgend, Schläfen deshalb flach gewölbt. Ocellenstellung fast rechtwinklig, POL: OOL=1: 2. Kopf im ganzen flach, Stirn vor dem Fühlersockel und seitlich davon leicht eingedrückt (vom Scheitel her deutlich sichtbar!). Innenränder der Augen nach oben kaum konvergent, ein Auge deutlich breiter als eine Stirnhälfte. 3. Fühlerglied viel länger als Schaft + Pedicellus, 4. Glied auch noch länger, 5. Glied=Schaft + Pedicellus. Vorderrand des Clypeus deutlich wellig: beiderseits der bogig vorgezogenen Mitte bogig ausgerandet, seine seitlichen Ecken abgerundet. Wangen kaum entwickelt.

Postnotum so lang wie $\frac{1}{2}$ Postscutellum, hinten (mitten) deutlich stumpfwinklig ausgeschnitten, sehr fein runzelig quer gestreift, mitten linear geteilt, die Teilung nicht bis zum Vorderrand reichend.

Klauen gestreckt, mit einem kräftigen Zahn.

Sarawak, Mt. Dulit (4000 Fuss) Moos-Wald. 18. x. 32.

♂.—Länge 13 mm. Schwarz, teilweise ockerfarben, golden pubeszent. Ockerfarben sind: Basis der Fühler (Schaft und Pedicellus), Taster, Tegulae und Flügelwurzel. Hinterrand des Pronotums (unter der Pubeszenz), Beine mindestens von den Knien an, an den Hinterbeinen auch

die Schenkel. Verteilung der goldenen Pubeszenz wie beim ♀, Behaarung etwas stärker.

Flügel stärker gebräunt als beim ♀, gegen die Basis aufgehellt, mit braunen Längsflecken in der Subcostalzelle, der 2. und 3. Radialzelle.

Körper jenem des ♀ ähnlich, aber: Vorderrand des Clypeus fast gerade; 1. Abdominal-Segment gestreckt, allmählich erweitert, etwa 2mal so lang wie hinten breit.

Klauen der Mittel- und Hinterbeine einfach, jene der Vorderbeine mit Zahn dicht hinter der Spitze (fast gespalten).

Genitalplatte breit dreieckig, mit schmal-rechteckiger Mittelbahn, die von einer flachen Längsrinne durchzogen wird und am Ende gerade abgeschnitten ist; die Seitenteile der Platte sind dreieckig, stumpfwinklig zurückgebrochen. Rand der Platte mit langen Haaren besetzt.

Sarawak, Mt. Dulit (4000 Fuss) im Moos-Wald (Unterholz), 15. x. 32.

Platydialepis moorei, sp. n.

♀.—Länge 13 mm. Blauschwarz, silbern pubeszent, Unterseite der Hinterschenkel mit weisslichem Fleck. Die silberne Pubeszenz ist bei dem mir vorliegenden Exemplar stark abgerieben, ist aber deutlich vorhanden auf dem Untergesicht und dem Clypeus, vor dem Hinterrande des Pronotums, an dessen Seiten sowie auf den Seiten des Thorax und den Coxen, vor dem Hinterrande des Propodeums und an den Seiten des Abdomens. Die Verteilung der Pubeszenz scheint ähnlich gewesen zu sein wie bei *Pl. hobbyi*. Behaarung auf Schläfen, Seiten des Thorax und Bauchseite des Abdomens ziemlich lang weisslich und dicht.

Flügel auf ihrer proximalen Hälfte hyalin, auf ihrer distalen Hälfte rauchig getrübt.

Kopf und Fühler wie bei *Pl. hobbyi*, Stirn aber völlig eben; Vorderrand des Clypeus weniger deutlich wellig.

Postnotum hinten (mitten) gerade, im übrigen wie vorher.

Klauen gestreckt, mit einem kräftigen Zahn.

♂ unbekannt.

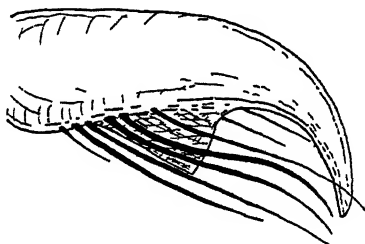
Sarawak, am Zusammenfluss von Tinjar und Lejok, 4. ix. 32, mittels der Lichtfalle erbeutet im alten sekundären Forst.

*MACROMERINÆ.*1. Tribus *MACROMERINI*.

♂♂ von kräftigerem Körperbau und durchschnittlich grösser als die ♀♀. Vor allem ist das ♂ dem ♀ gegenüber ausgezeichnet durch etwa quadratisch begrenztes Propodeum, dickere Schenkel und mitten bogig ausgeschnittenen Clypeus. Schenkel der Mittel- und Hinterbeine mit flacher Einschlagrinne für die Schiene, diese Rinne zu beiden Seiten mit \pm kräftig gezähnelten Rändern.

Beim ♀ ist das Propodeum deutlich verschmälert nach rückwärts, die Schenkel sind dünn und lang (ungezähnt), der Clypeus ist vorn stumpfwinklig gerandet und mitten deutlich mit einer knöpfchenartigen Spitze versehen. Der Maxillar-Cardo ist mit kräftigen, nach vorn gerichteten Borsten (einem sogenannten Kinnbart) versehen,

Fig. 1.

Klaue eines Hinterfusses von *Macromeris*.

der bis an die Mandibeln heranreicht, zuweilen aber zwischen die Maxillen zu liegen kommt, so dass er nicht gesehen werden kann. (Ich habe diesen Kinnbart bisher auch übersehen.)

Fühler ♂♀ nicht voneinander verschieden, ihr 3. Glied viel länger als Schaft + Pedicellus, fast = 2mal Schaft. Subcostalzelle im Vorderflügel gestreckt, mindestens ihr äusserstes distales Ende abgerundet; 1. Medialquerader steil gestellt. Mesosternum (Subcoxen) vor den Mittelhüften \pm kegelförmig gehoben. Klauen sichelartig gekrümmt, mit kräftigem Zahn in der Mitte, auf der Innenseite mit 4 kräftigen Borsten in Längsreihe von der Basis her; diese Borsten sind oft zum Teil abgebrochen. (Fig. 1.)

1. Subcostalzelle der Vorderflügel distal deutlich erweitert, der 4. Abschnitt des *R* steil ansteigend und die Zelle in ihrer ganzen Breite abrundend (ähnlich wie bei *Pepsis*); Pterostigma kurz, etwa ebenso lang wie der 1. Abschnitt des *R*. Cubital-Querader (olim Anal-Querader) im Hinterflügel distal hakenförmig gebogen, deutlich postfurcal oder interstitial mündend. —Augen auf dem Scheitel fast ebenso weit voneinander entfernt wie am Clypeus; Wangen auffällig entwickelt, etwa so lang wie eine Mandibel an ihrer Basis breit. Höcker des Mesosternums mit zitzenartigen Gipfeln, die nach aussen gespreizt stehen und bei Betrachtung schrag von oben deutlich sichtbar sind. Propodeum ohne Infrastigmal-Tuberkeln, niemals von vorn an quer gerunzelt. Hinterschienen (\pm auch die Schienen der übrigen Beine, vor allem beim ♂) oberseits locker, unterseits zottig behaart. Schenkel ♂ unterseits sehr deutlich gezähnelte oder gekerbt, und zwar die Vorderschenkel nach unten bogig erweitert und mit kräftig gezähneltem Grat versehen; Mittel- und Hinterschenkel verdickt und mit je zwei gezähnelten Graten, von denen der vordere vom Knie an nur bis gegen die Mitte reicht, der hintere aber durchläuft, zwischen beiden Graten eine flache Einschlagrinne für die Schiene. Grosse Arten

1. Gattung: *Macro-*
T.g. *M. splendida* Lep.

[*meris* Lep.
Subcostalzelle der Vorderflügel distal nicht erweitert, der 4. Abschnitt des *R* schräg ansteigend und nur an seinem äussersten Ende einwärts gebogen; Pterostigma gestreckt, etwa 2mal so lang wie der 1. Abschnitt des *R*. Cubital-Querader im Hinterflügel distal von Kreishöhen-Krümmung, antefurcal mündend. —Augen auf dem Scheitel nur $\frac{1}{2}$ so weit voneinander entfernt als am Clypeus; Wangen kurz, kaum $\frac{1}{2}$ so lang wie eine Mandibel an ihrer Basis breit. Höcker des Mesosternums nur rundlich zugespitzt, Gipfel nach unten gerichtet, von oben nicht sichtbar. Propodeum mit stumpfen Infrastigmal-Tuberkeln, von vorn an quer gerunzelt. Hinterschienen nicht behaart, dafür mit feinen Dörnchen versehen. Schenkel ♂ unterseits wenig auffallend wellig bis gekerbt, Vorderschenkel normal, unten ohne gezähnelten Längsgrat. Bis jetzt nur eine mittelgrosse Art

2. Gattung: *Macro-*
[*merella* Banks, 1934. T.g. *M. honesta* Sm.

Ich fasse die Macromerini enger als Banks und lasse die Gattung *Paragenia* Bingh. aus. Diese und die übrigen Gattungen der Macromerinae dürften in den beiden Tribus Pseudageniini und Deuterageniini unterzubringen sein.

1. Gattung : MACROMERIS Lep.

(Die mit * versehenen Arten haben mir nicht vorgelegen.)

1. Flügel hell gefärbt, \pm hyalin oder in der Aufsicht hellbraun und dann nur mit geringem Glanz 2.
Grundfärbung der Flügel in der Aufsicht nicht oder kaum zu erkennen, durch \pm brillanten Glanz überstrahlt. Körperfärbung schwarzblau bis schwarz 4.
2. ♂ unbekannt.
♀ 24 mm. Flügel gelb-hyalin, wohl kaum irisierend. Körperfärbung dunkel kastanienrot; Scheitel und Seiten des Thorax schwarzbraun; Abdomen mit schwarzbraunen Binden auf den Hinterrändern der Tergite, diese Binden seitlich abgekürzt, auf Tergit 1-4 mitten dreieckig vorgezogen. Propodeum kurzrunzlig, zwischen den Runzeln grubig punktiert.—Java *1. *castanea* Bingh.
3. Flügel in der Aufsicht hellbraun 3.
♂ 24 mm. "Flügel gleichmäßig hellbraun, mit schwachem Glanze, im basalen Teile vorwiegend blau bis blaugrün (sogar goldgrün), im distalen Vorderrande (schon die 1. Radial... olim Cubital... zelle) hellviolett; Geäder dunkler." Grundfärbung des Körpers dunkel kirschrot, am Thorax \pm schwarz überdeckt; Abdomen \pm blau schimmernd; Fühler gegen ihre Spitze aufgeheilt.—Propodeum breiter als lang (ähnlich *robusta*), fast kahl, unregelmässig netzartig skulptiert; mittlere Längsfurche vorhanden. Mesosternalhöcker stark entwickelt, mit zitzenartigem Gipfel.

Vor Jahren lag mir ein ♀ vor, das ich auf diese Art bezogen habe (Bull. Mus. Roy. d'Hist. nat. Belg. ix. 1933, p. 3).

♀ 24 mm. Blauschwarz, Abdomen glänzend. Behaarung des Vorderkörpers lang und zottig, aber wenig dicht; Abdomen spärlich behaart, sein Rücken kahl.

Flügel färbung wie beim ♂: vorwiegend stahlblau, gegen die Basis in Grün übergehend, gegen die Spitze in Rotviolett übergehend.

Kopf hinter den Augen verschmälert, dick, Wangen auffallend lang. Ocellen-

stellung spitzwinklig, POL : OOL = 2 : 5
Postscutellum mit netzartiger Skulptur
an den Seiten. Postnotum mitten ge-
teilt, beiderseits mit 4 gebogenen Quer-
runzeln. Propodeum netzartig skulp-
tiert. Seiten des Thorax dicht quer-
gerunzelt. Die buckelige Erhebung vor
den Mittelhüften trägt einen glatten
Höcker, der central gestellt und gerade-
aus gerichtet ist.—Palawan. *palawanensis R. Luc.

Banks (1934) stellt die Art in seine Gattung *Macromerella*. Schon
wegen der stark entwickelten Höcker auf dem Mesosternum muss die
Art bei *Macromeris* bleiben.

♂ 25 mm. "Flügel hellbraun, im basalen
Teile mit schwachem rötlich-violettem
Glanze, auch am Gader des distalen
Teiles, der in der gesamten Fläche einen
schwachen gelben (auch messingenen)
Glanz zeigt." Körperfarbe jener der
vorigen Art sehr ähnlich, "doch ist
die kirschbraune Färbung einem dunklen,
schwarzblauen, teilweise auch tief pur-
purvioletten Kolorit gewichen und nur
die Schienen und Tarsenglieder zeigen
noch die braune Färbung mit dem
hellen, rötlich-violetten Anfluge."—Pro-
podeum (nach der Abbildung bei Lucas!)
breiter als lang, "im mittleren Teile
unregelmässig grob punktiert, während
vor den Hinterecken die Tendenz zu
einer, wenn auch unregelmässigen,
Querrunzelung unverkennbar ist; die
Oberfläche zeigt einen wenig stärkeren
Schimmer (als der übrige Körper);
Querrunzeln unterhalb des Stigmas sind
ebenfalls vorhanden"; Behaarung sehr
schwach (kahl?), Mittelfurche angedeutet.
Höcker des Mesosternums mit abgerunde-
ter Spitze.

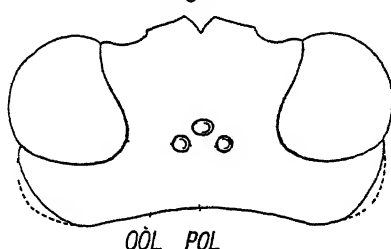
♀ unbekannt.—Philippinen (Mindanao)... *3. *mindanaensis* [R. Luc.]

Lucas ist sich nicht klar darüber, ob diese Art selbständig oder nur
eine Varietät der vorigen ist. Wegen der viel geringeren Entwicklung
der Höcker des Mesosternums und der abweichenden Skulptur auf
der Oberseite des Propodeums halte ich *mindanaensis* für eine gute
Art.—Wie Lucas am Schlusse seiner Diagnose angibt, lag ihm ausser
einem ♂ von Mindanao noch ein Exemplar von Papua vor, und er
setzt hinter diese Angabe: (!?). Mit Papua meint er vielleicht Neu-
Guinea. Leider sagt er nicht, von welchem der beiden Exemplare er die
Abbildung des Propodeums gab mit dem strahlenförmigen Verlauf
der Querrunzeln ausserhalb der quergestreiften Mittelfläche, was ja
zu seiner Beschreibung der Skulptur des Propodeums nicht passt.

4. Propodeum ± netzrunzelig punktiert bis
kurzrunzelig, auf seiner hinteren Hälfte
niemals mit durchlaufenden Querrunzeln,
bei ♀ stark behaart 5.
Propodeum mindestens auf seiner hinteren
Hälfte mit ± durchlaufenden Querrun-
zeln, beim ♂ völlig kahl..... 7.

5. ♂ 22 mm. Kopf hinter den Augen deutlich verschmalert, nach der Abbildung bei Bingham, nach seinen Angaben dem ♀ ähnlich.
- 2 ♀ 21 mm. Kopf hinter den Augen deutlich verschmalert (fig. 2). Propodeum gleichmassig fein netzartig skulptiert, ohne mittlere Längsfurche. Zottige Behaarung auf der Unterseite der Hinterschienen anliegend und deshalb weniger auffallend. Flügel heller bis dunkler stahlblau glanzend, auf den Vorderflügeln der Spitzenrand \pm mattschwarz, auf den Hinterflügeln violett.—Mir lag 1 ♀ vor von Borneo (Sarawak—Mt. Duht, 4000 Fuss), das als Holotype zu gelten hat. Nach Bingham's Angaben auf dem festlandischen Indien (ausgenommen die sehr trockenen Gebiete), auf den Andamanen, in Assam, Birma, im Tenasserim

Fig. 2.



Kopf von *Macromeris indica*; punktiert: Schlafenbildung von *M. violacea*, *splendida*, etc. *POL*=Postocellar-Linie, *OOL*=Ocular-Ocellar-Linie.

und auf der malayischen Inselwelt verbreitet (vgl. Fauna Brit. Indien, Hym.

i. 1897, p. 104 & 105!) 4. *indica*, sp. n.

[(=*M. violacea* Bingham, nec. Lep.).

- ♂♀. Kopf hinter den Augen cylindrisch; Propodeum mit mittlerer Längsfurche. (Fig. 2.) 6.
6. ♂ 25–30 mm. Propodeum ebenso breit wie lang, netzartig skulptiert, vorn feiner, nach hinten zunehmend grober. Abdomen dem Vorderkörper entsprechend schmal, sein 2. Tergit so breit wie lang.
- ♀ 25 mm. Propodeum gleichmassig fein netzartig skulptiert, die mittlere Längsfurche beiderseits von niedrigem Grat begrenzt.
- ♂♀. Färbung des Abdomens schwarzblau, der übrige Körper schwarz, Beine beim ♂ zuweilen \pm dunkel kirschrot. Flügel von der Basis her \pm weit bronzeglänzend,

dann \pm weit violett und auf der Spitze der Vorderflügel dunkel stahlblau.—Java (Ost-Java, Banjoewangi).....

5. *splendida* Lep.

♂ 31 mm. Propodeum deutlich breiter als lang; netzrunzelig skulptiert, vorn feiner, nach hinten zunehmend grober, auf seiner vorderen Hälfte ausserdem mit tiefer eingestochenen Punkten in den Vertiefungen, in der breiten mittleren Längsfurche verworren querrunzelig. Abdomen kürzer als der auffallend breite Thorax, mitten ebenso breit wie dieser, das 2. Tergit viel breiter als lang.—Färbung des Abdomens dunkelblau, des übrigen Körpers und der Beine schwarz. Flügelglanz nicht intensiv, violett und gelblich-bronzefarben, letztere Farbe vor allem auf der Mitte der Hinterflügel.

♀ unbekannt.—Java (Ost-Java, Banjoewangi)

6. *robusta*, sp. n.

1 ♂ (Holotype) in meiner Sammlung.

7. Querstreifung des Propodeums \pm verworren runzelig, auf seiner hinteren Hälfte mit flach maandrisch (geschlängelt) verlaufenden längeren Querrunzeln

8.

Querstreifung des Propodeums mindestens auf dessen hinterer Hälfte deutlich, ziemlich gerade, seitlich gerichtet

9.

8. ♂ 28 mm. Oberseite des Propodeums dicht und grob punktiert, die zwischen den Punkten liegenden Runzeln fliessen zu einem unregelmässigen und zum Teil undeutlichen Netzwerk zusammen; seitlich bilden die Runzeln eine deutliche Streifung mit der Richtung nach rückwärts; mittlere Längsfurche leicht eingedrückt.

♀ 28 mm. Propodeum ähnlich skulptiert, aber weniger scharf ausgeprägt.

Färbung ♂♀ auf dem Abdomen violett infolge Pubeszenz. Flügel mit strahlend tiefblauem Glanz, auf einzelnen Stellen und am Spitzensaum der Vorderflügel violett, an der Basis und (beim ♀) auf den Hauptadern goldgrün, desgleichen auf dem Saum der Hinterflügel. Beine an den Gelenken und auf der Innenseite der Schenkel pechbraun, beim ♂ auch die Aussenseite der Mittelschenkel und die Basis der Tarsenglieder pechbraun.—Ehem. Deutsch Neu-Guinea ...

[R. Luc.

*7. *fulgidipennis*

♂ 30 mm. Oberseite des Propodeums vorn netzrunzelig, auf der hinteren Hälfte mit unterbrochenen, unregelmässig geschlängelten Querrunzeln, mitten mit schmaler Längsfurche.—Färbung des Abdomens blauschwarz, des übrigen Körpers und der Beine schwarz. Flügel mit vorwiegend blauem Glanz, an der

Basis der Vorderflügel und auf den Hinterflügeln mit Grün gemischt, auf den Vorderflügeln gegen die Spitze mit Violett.

♀ unbekannt.—Ehem. Deutsch Neu-Guinea (Finsch-Hafen) leg. Hertle . . .

8. *aberrata*, sp. n.

1 ♂ (Holotype) in meiner Sammlung.

9. ♂♀ 28–29 mm. Propodeum sehr fein gerunzelt und matt. Färbung blauschwarz, Abdomen mit irisierender Pubeszenz. Flügel mit violettem Glanz, blau irisierend.—Aru-Inseln . . .

9. *iridipennis* Sm.

Propodeum mit breiten Runzeln . . .

10.

10. ♂ 28 mm. Propodeum vorn netzrunzelig, hinten deutlich quer gerunzelt; die mitten liegenden Runzeln sind seitlich abgekürzt und etwas schräg nach vorn gerichtet, die dahinter liegenden Runzeln ziehen gerade zur Seite; mittlere Längsfurche vorn sehr schmal, nach rückwärts allmählich verbreitert.

♀ 26 mm. Propodeum ebenso, aber viel feiner skulptiert, die Struktur aber unter der Behaarung nicht so gut zu erkennen wie beim ♂. Färbung ♂♀ völlig schwarz, Abdomen etwas blau schimmernd, besonders beim ♂.—Flügel ♂ mit hellblauem Glanz mit Beimischung von Grün. Flügel beim ♀ ebenfalls mit blauem Glanz, der aber nach aussen ± violett wird.—Ehem. Deutsch Neu-Guinea (Finsch-Hafen) leg. Hertle . . .

10. *violacea* Lep.

♂ 26 mm. Propodeum vorn netzrunzelig skulptiert, auf der hinteren Hälfte mit quer gerichteten Runzeln, die aber schräg nach rückwärts ziehen; die mittlere Längsfurche ist verhältnismässig breit, und mitten in ihr liegt noch ein flacher Grat, so dass 2 nebeneinander liegende Furchen entstehen. Abdomen deutlich kürzer als der Vorderkörper, etwa so lang wie der Thorax, dunkelblau gefärbt; der übrige Körper ist schwarz gefärbt, aber die Beine dunkelblau. Glanz der Flügel fast rein dunkelblau.—Neu-Guinea . . .

11. *azurea*, sp. n.

1 ♂ (Holotype) in meiner Sammlung.

Die Herkunft dieser Art ist nicht ganz sicher. Ich erhielt sie vor etwa 20 Jahren von Herrn W. Schlüter-Halle geschenkt, der sie zwischen älteren Beständen seines Geschäftshauses gefunden hatte, unter denen sich aber viel Material von den Aru-Inseln befand.

Macromeris indica, sp. n.

Nach den Abbildungen, die Bingham von seiner *M. violacea* gibt (Fauna Brit. Ind. Hym. i. 1897, f. 21 ♂ *Ann. & Mag. N. Hist.* Ser. 11. Vol. vii. 5

p. 104 und f. 23 ♀ p. 105), muss ich annehmen, dass die mir von Borneo vorliegende Art (1 ♀) hiermit übereinstimmt, was durch die Beschreibung bestätigt wird. Sie ist aber auf keinen Fall identisch mit irgendwelcher Art von Neu-Guinea, also auch nicht mit *M. violacea* Guér.

♀.—21 mm. Schwarzblau; Kopf, Thorax und Unterseite des Abdomens mit langen schwarzen Haaren bedeckt.

Flügel in der Durchsicht dunkelbraun, mit streifenförmiger, schrägliegender heller Makel in der 2. Medialzelle; im auffallenden Licht glänzen die Flügel stahlblau bis violett, wobei die am Spitzenrand liegenden Teile mattschwarz bis bronzefarben erscheinen. Die Aderung zeigt keine besondern Abweichungen.

Kopf hinter den Augen deutlich verschmälert (Vgl. fig. 2!); Schläfen lang abgewölbt, so dick wie die Augen.

Fig. 3.



Querrunzeln (Teilungs-Figur) des Postnotums von *Macromeris indica* ♀.

Ocellenstellung leicht spitzwinklig, POL:OOL=fast 1:2. Ein Auge mitten so breit wie eine Stirnhälfte. 3. Fühlerglied viel länger als Schaft + Pedicellus, letztere zusammen=4. Glied. Vorderrand des Clypeus in eine etwas aufgerichtete Spitze ausgezogen wie bei den übrigen Arten. Ausmodellierung des Thorax ebenfalls nicht abweichend, seine Seiten aber (im Gegensatz zu *M. violacea* Lep.) netzartig skulptiert.

Postscutellum mit seinem Gipfel nicht ganz die Höhe des Scutellums erreichend, hinten senkrecht zum Postnotum abfallend. Postnotum kaum $\frac{1}{2}$ so lang wie das Postscutellum, deutlich quer gerunzelt, mitten linear geteilt. Die Querrunzeln sind beiderseits der Mitte flachbogig nach vorn geschwungen, und durch die Teilung in der Mitte werden sie nicht völlig durchschnitten, sondern nur niedergedrückt (fig. 3).

Propodeum netzartig skulptiert, wobei besonders die quer gerichteten Leisten hervortreten, ohne das Bild eines unregelmässigen Netzmusters zu stören.

Alle übrigen Merkmale wie bei den andern Arten.

♂ mir nicht bekannt

Mir lag vor 1 ♀ von Sarawak (Mt. Dulit, 4000 Fuss, Moos-Wald) vom 18. x. 1932, das als Holotype zu gelten hat.

Im Folgenden gebe ich eine Aufteilung der 1. Tribus der Macromerinae und im Anschluss daran eine Tabelle der mir bisher bekannt gewordenen Arten der Gattung *Macromeris* Lep.

ANMERKUNGEN.

Macromeris splendida Lep.

Über deren Flügelfärbung sagt ihr Autor: "Alae a basi paulo ultra dimidium subferrugineo-luteae, dein ad apicem usque paulatim fuscantes et violaceo splendide nitentes: insuper ala tota aureo pulchre micans. ♂." Diese Beschreibung passt auf die mir vorliegenden 4 ♂♂ und 2 ♀♀ gleicher Herkunft (Java). Ungefähr passt sie allerdings auch auf das kräftigere und grössere ♂ der *M. robusta* m.— Nach seinen Angaben lagen Lepelletier 3 verschiedene Grössen seiner Art vor; die Hälfte seines Materials hatte eine Länge von 14 ln. (französisches Mass: 1 lin. = 2.255 mm.) = fast 32 mm, die übrigen waren um 1/3 länger, also etwa 40 mm, und ein Stück mass nur 15–16 mm. Ich will nun annehmen, dass die 31–32 mm langen Stücke meiner Sammlung jener Art entsprechen, die wirklich *splendida* Lep. ist, die grösseren aber als *robusta* gelten können, wenn die Masse meiner Tiere auch geringer sind und ich denken muss, dass mir ein recht kleines ♂ von *robusta* vorliegt. Das kleinste von Lepelletier erwähnte Stück mag vielleicht auch *splendida* sein. Leider sind in Paris keine Typen vorhanden, wovon ich mich bei meinem Dortsein überzeugen konnte.

Fr. Smith gibt als Fundorte der Art an: Indien, Malacca, China, Borneo (Sarawak), Java und Celebes, von denen jedenfalls nur Java zu Recht bestehen bleiben dürfte.

Macromeris violacea Lep.

Auch diese Art wird nur nach ihrer Färbung beschrieben; eine Type ist nicht vorhanden. Über die Flügelfärbung heisst es: "Alae violaceo-nigrae, splendide caeruleo

nitentes. ♂." Da die Flügel der andern Arten Neu-Guineas abweichend gefärbt sind, so nehme ich an, dass ich in der Tabelle die richtige Art behandle, umsomehr, als dies die häufigere zu sein scheint. Über die Länge des Tieres sagt die Urbeschreibung nichts.

Fr. Smith gibt als Fundorte an: Assam, Malacca, Gilolo, Ceram, Buru, Celebes, Neu-Guinea und Aru. Die beiden letzten Fundorte kommen wohl als einzige in Frage, vielleicht nur Neu-Guinea.

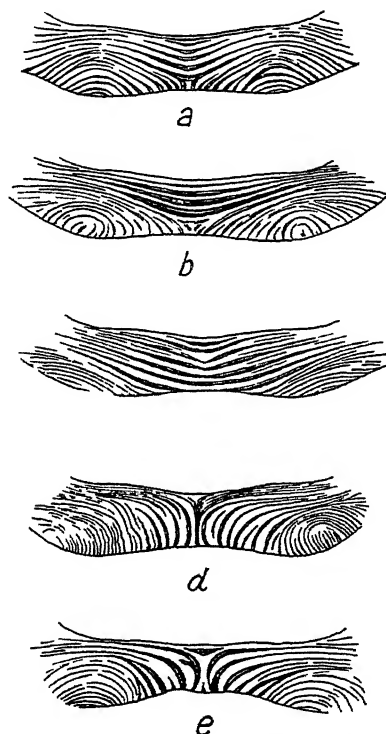
Zur Skulptur des Postnotums des Metathorax.

Die in Fig. 4 dargestellten Teilungs-Figuren des Postnotums (letzter Abschnitt des Metanotums), das \pm versenkt liegt zwischen dem Postscutellum und dem Propodeum, sollen im vorliegenden Falle nur zur Prüfung dienen, ob man nach meiner Tabelle richtig bestimmte. Einen absoluten Richtigkeits-Wert haben die Figuren nicht, da (wie ich bei meinen 4 ♂♂ von *M. splendida* gesehen habe) der Verlauf der erhabenen Linien (der Quer-Runzeln) niemals der völlig gleiche ist, wenn auch ein Durchschnitts-Bild festgehalten wird; ausserdem herrscht keine völlige Übereinstimmung zwischen rechts und links bei ein und derselben Figur. Dass aber trotzdem jede Figur einen ebenso bestimmten wie unverkennbaren Charakter trägt, lässt sich durch vergleichendes Betrachten leicht feststellen. Ferner wird man erkennen, dass die Linien-Skulptur bei geographisch zusammengehörenden Arten eine gewisse Ähnlichkeit besitzt: Bei den Arten von Neu-Guinea ziehen die erhabenen Streifen in flachem Bogen über die Mitte des Postnotums hinweg, während bei den Arten von Java eine deutliche mittlere Teilung durch den steilen Anstieg der Runzeln bewirkt wird. Für das Wiedererkennen einer Figur ist ausserdem wichtig, die zu beiden Seiten der Mitte (vor der Grenze des Propodeums) vorhandenen kleineren Bogen-Figuren zu beachten, die von dichtgestellten feinen Runzeln gebildet werden. Endlich sei noch gesagt, dass betreffs der Teilungs-Figur zwischen ♂ und ♀ eine ziemliche Ähnlichkeit herrscht, wodurch es möglich wird, die Geschlechter einer Art unzweifelhaft zusammen zu bringen.

Nach den vorangehenden Erörterungen wird man

verstehen, dass ich die an sich wohl wichtigen Figurenbildungen, die bei andern Gattungen streng eine bestimmte Form festhalten, in der Tabelle nicht berücksichtigte.

Fig. 4.



Teilungs-Figuren des Postnotums von *Macromeris* ♂♂: (a) *aberrata*, (b) *azurea*, (c) *violacea*, (d) *robusta*, (e) *splendida*.

Weiterhin ist bei dieser Gattung bemerkenswert, dass eine Unterscheidung der ♂♂ nach den sehr gleichförmig gebauten Genitalplatten kaum möglich ist.

NOMENCLATUR.

Ein mir von Borneo vorliegendes ♀, das nach Bingham als *M. violacea* Lep. hätte angesehen werden müssen, wurde für mich zum Anlass, die bis jetzt beschriebenen

Arten dieser Gattung zusammen mit jenen, die sich in meiner Sammlung befinden, zu bearbeiten. Das ♀ von Borneo konnte auf keinen Fall identisch sein mit einer auf Neu-Guinea vorkommenden Art (*violacea* Lep.); vom tiergeographischen Standpunkt aus wäre das unmöglich gewesen. Meine früheren Versuche, alle in meinem Besitz befindlichen Arten zu bestimmen, waren vergeblich. Was mir vorlag, waren entschieden 5 Arten, von denen sich aber bloss 2 indentifizieren liessen. Mittels der bisher einzigen umfassenderen Arbeit von R. Lucas, auf die ich noch zu sprechen komme, war 1.) *M. splendida* Lep. sicher zu erkennen, wozu aber schon die Beschreibung seitens Lepelletier ausreichte in "Magaz. zool. i. 1831 (1830) p. 29–30 ♀♂ t. 30 ♂," wiederholt in "Hist. nat. Ins. iii. 1845 p. 464 n. 2." Lepelletier hat, wie damals üblich, die Arten nur nach ihrer Färbung charakterisiert. Ausser *splendida* von Java liess sich nach seinen Angaben 2.) *violacea* (♂) von Neu-Guinea erkennen, vor allem an der Flügelfärbung, die beim ♀ indes abweicht und mehr ins Rötliche spielt.

Wo es mir möglich war, richtete ich mich bei meinen Diagnosen vor allem nach plastischen Merkmalen, musste aber jene Arten, die mir nicht durch Autopsie bekannt waren, nach literarischen Quellen gemäss ihrer Färbung behandeln; 11 Arten ergaben sich. Ob nun mit den hier dargestellten 11 Arten die Reihe der tatsächlich vorkommenden *Macromeris*-Species erschöpft ist, kann wohl bezweifelt werden. Die Arbeit von R. Lucas "Pompiliden-Studien. ii. 2. Die Gattung *Macromeris* (Arch. f. Naturg. Abt. A. 10. Heft 1919, p. 132–162 mit 2 Tafeln)" kennt deren nur 7 (8). Leider muss von dieser Arbeit gesagt werden, dass sie nahezu unbrauchbar ist, vor allem deshalb, weil dem Autor gerade jenes Material fehlte, das für die Klarstellung der von Lepelletier beschriebenen beiden Arten (*splendida* u. *violacea*) nötig war. Von *splendida* sagt er: "Männchen unbekannt," trotzdem Lepelletier nur das ♂ beschreibt. Das Lucas einzig vorliegende ♀ stimmt nach seiner Diagnose mit jenem überein, das auch ich für das richtige ♀ halte und das ich meiner Beschreibung zu Grunde gelegt habe. Von Neu-Guinea lagen R. Lucas nur 1 ♀♂ einer entschieden neuen Art vor, die er als *M. fulgidipennis* publiziert (p. 151), die er aber p. 140 für übereinstimmend

mit *violacea* Lep. halten möchte. Ebenso verfährt er mit einer andern Art (*violaceipennis*, sp. n.), die er nicht unterbringen kann, die er aber für übereinstimmend halten möchte mit *M. iridipennis* Sm., die ich weiter hinten behandle. Auf p. 151 vergleicht er letztere mit *violacea* Lep. nach den Angaben der beiden Autoren. Im übrigen steht es für ihn fest, dass die Art, die Bingham als *violacea* beschreibt, mit dieser Art auch wirklich übereinstimmt. Das massgebliche Merkmal für die Kennzeichnung einer Art ist ihm die Flügelfärbung, nach der sich im vorliegenden Falle tatsächlich einige Arten erkennen lassen. Immerhin ist dieses Merkmal insofern unsicher, als zwischen ♂ und ♀ Unterschiede bestehen können. Am sichersten leiten morphologische Merkmale, besonders die Skulptur des Propodeums, und zur Kontrolle der Richtigkeit einer Bestimmung ist ferner die Beachtung der Teilungs-Figur des Postnotums von einiger Wichtigkeit, wenn ich dieses Merkmal auch für meine Tabelle nicht benutzte; ich gebe Abbildungen davon bei den angehängten Einzel-Besprechungen.

Was nun *M. violaceipennis* R. Luc. = (*iridipennis* F. Sm. ?) betrifft, so ist hier von Lucas ein Verfahren angewendet worden, dessen Nachahmung nicht empfohlen werden kann. Die Beschreibung dieser Art umfasst (p. 141) 2 Zeilen, und der Grössen-Angabe wird mit "Kleine Art" abgetan. Über ihre Herkunft wird zunächst im Text nichts gesagt. Auf den beiden Tafeln findet man 5 Abbildungen von Einzelheiten: Auf Tafel I sieht man als Fig. 3 u. 6 das Mittelsegment, jedesmal in derselben seitlichen Ansicht, aber von verschiedenem Umriss und mit verschiedener Skulptur. Tafel II Fig. 26 zeigt das Mittelsegment ♂ in der Aufsicht und die beiden Fig. 36 u. 40 geben Teile der Aderung wieder. Hinter dem Hinweis auf Fig. 36 T. I. kann man dann noch lesen: Milne Bay; wo diese liegt, wird nicht gesagt. Ich ermittelte sie am Ostzipfel von Neu-Guinea. Text und Abbildungen zusammen dürften kaum ausreichen, die Art zu erkennen.

Endlich wird *M. iridipennis* Sm. (p. 150) als gute Art behandelt, was sie wohl auch ist, trotzdem sie von Bingham als Varietät von *violacea* aufgefasst wird.

Der von R. Lucas am Schluss seiner *Macromeris*-Bearbeitung gebotene Vergleich zwischen den Gattungen *Macromeris*, *Hemipepsis* und *Pepsis* ist wertlos.

Der letzte Autor, der bemerkenswerte Angaben betreffs *Macromeris* macht, ist N. Banks. Die Bearbeitung von Bakers Nachlass in "The Psammocharidæ of the Philippines" (Proc. Am. Ac. Arts. Scs. vol. lxix. 1934, pp. 1–117) lässt bei der Aufzählung von *M. splendida* Lep., *violacea* Lep. und *iridipennis* Sm. p. 32 aber nur das Bedauern darüber aufkommen, dass nichts Genaueres gesagt wurde. Ich nehme an, dass Banks keinerlei Vergleichs-Material von Neu-Guinea vorlag. Vielleicht entschliesst sich Banks, die ihm von den Philippinen vorliegenden Arten genau zu beschreiben. Ich kann mir vorläufig nicht vorstellen, dass die Beziehungen zwischen Neu-Guinea und den Philippinen derart innig sind, dass die gleichen Arten von *Macromeris* in beiden Gebieten vorkommen.

2. Tribus PSEUDAGENIINI.

CHRYSAGENIA, gen. nov.

T.g. *Agenia daphne* Sm., Journ. Proc. Linn. Soc. Zool. ii. 1858, p. 95, n. 10, ♀.

Körper schlank und schmal; Beine, Fühler und Maxillar-Taster auffallend lang und dünn. Abdomen so lang wie der gesamte Vorderkörper mit dem Kopf; die ausgestreckten Fühler (♀♂) würden bis zum Ende des 2. Abdominal-Tergits reichen, die Taster bis zum seitlichen Hinterrande des Pronotums. Kopf flach, Schläfen stark abgeschrägt, ein Auge (mitten) breiter als eine Stirnhälfte, Ocellenstellung spitzwinklig; Clypeus ♀ vorn stumpfwinklig, ♂ flach abgerundet, Wangen nicht entwickelt. Scutum so lang wie Scutellum + Postscutellum + Postnotum; Postnotum kaum skulptiert, so lang wie das Postscutellum; Propodeum länger als Scutellum + Postscutellum + Postnotum, sehr flach gewölbt, etwa so lang wie breit, Infrastigmal-Tuberkeln nicht vorhanden. Stiel des Abdomens ♀ fast $\frac{1}{2}$ so lang wie das 1. Segment, beim ♂ schlank, allmählich verbreitert. Tarsenglieder gestreckt; Klauen ♀ gerade, mit kräftigem Zahn im vorderen Drittel; Klauen ♂ ebenfalls gerade, mit Zahn dicht hinter der Spitze.

Flügel ♀: 3. Radialzelle trapezisch, distal deutlich erweitert, deutlich länger als die 2. Radialzelle; die 2. Radialquerader gerade, kürzer als die Subcostalzelle hoch ist. Pterostigma so lang wie die 2. Radialzelle an

ihrer Basis. 1. Medialquerader gerade. Geäder beim ♂ ähnlich, Zellen entsprechend kürzer als beim ♀.

Vielleicht gehört in diese Gattung *Macromeris aureo pilosa* Cam. (Straits Br. R. Asiatic Soc. 37. Journ. 1902, p. 88, ♀). Borneo.

Chrysagenia daphne Sm.

♀. Länge 13 mm. Schwarz; reich golden pubeszent. Golden sind: Kopf und Pronotum vollständig, Scutum hinten, Scutellum vollständig, die verbreiterten Seitenteile des Postnotums und daran anschliessend ein Fleck auf den Mesopleuren, ferner die Oberseite des Propodeums vorn und beiderseits der Mitte, sowie die Vorderseite aller Coxen. Behaarung auf Kopf und Thorax spärlich, auf dem Propodeum ziemlich dicht, hell; letzteres längs seiner Mitte und an den Seiten schwarz pubeszent.

Flügel gelblich; Vorderflügel mit rauchbraunem dreieckigem Fleck vor ihrer Spitze; die Spitze selbst ist leicht angeraucht. Der Fleck beginnt breit an der Costa in der Mitte des Pterostigmas, erfüllt noch die Subcostalzelle zu $\frac{2}{3}$ und zieht dann über die 2. und 3. Radialzelle bis in die 3. Medialzelle, wo er die 3. Medialquerader distal überschreitet.

Stirn fast eben, Fühlersockel kaum hervortretend, Clypeus mitten vorgewölbt. POL: OOL = fast 1:2. Postnotum so lang wie das Postscutellum, nadelrissig quergestreift, mitten linear geteilt. Propodeum mit flachen und breiten Querrunzeln, die unter Pubeszenz und Behaarung kaum zu erkennen sind.

Klauen gestreckt, mit kräftigem Zahn im vorderen Drittel, mit 4 Borsten in Reihe.

Sarawak, Zusammenfluss von Tinjar und Lejok, 14. ix. 32 von Eingeborenen erbeutet in 2500 Fuss (800 m) Höhe.

♂.—Länge 11 mm. Schwarz, ausgedehnt golden pubeszent, Fühler und Beine teilweise ockergelblich. Die goldene Pubeszenz ist dünner als beim ♀, dafür aber fast über den ganzen Körper ausgebreitet; auch das Abdomen schimmert je nach Beleuchtung fein golden. Seiten des Untergesichts, Unterseite der Fühler-Schäfte und die Mandibeln mit Ausnahme ihrer Spitze elfenbeinweiss, ebenso die Taster.

Proportionen und Skulptur des Körpers wie beim ♀.

Klauen gestreckt. mit Zahn dicht hinter der Spitze.

Genitalplatte lang und schmal (zungenförmig), fast eben, gegen ihr Ende auf halbe Breite verschmälert, auf ihrer Fläche locker behaart, am Ende mit einer Gruppe längerer Haare.

Sarawak. Zusammenfluss von Tinjar und Lejok. in altem sekundärem Wald, 15. ix. 32.

Trotzdem diesem ♂ der dunkle dreieckige, querbindenartige Fleck auf den Vorderflügeln fehlt und trotzdem die Beine hell gefärbt sind, betrachte ich es als zu dem *Chr. daphne*—♀ gehörig. Das einzige mir vorliegende ♂ hat als Allotype zu gelten. Leider fehlen an den Hinterbeinen Schienen und Tarsen; auch der rechte Fühler ist nur bis zum 3. Glied vorhanden.

Pseudagenia blanda Guér.

1 ♀ am Fusse des Mt. Dulit am Zusammenfluss von Tinjar und Lejok in altem Sekundär-Wald erbeutet, 15. ix. 32.

Meragenia borneana, sp. n.

Meragenia Banks, 1935.

♀.—Länge 8–9 mm. Schwarz; rot sind: 1. Tergit des Abdomens ohne die Basis, 2. Tergit völlig und die Basis des 3. Tergits, ebenso an den Hinterbeinen die Hüften und die Unterseite der Schenkel. Kopf runzlig punktiert, der ganze Thorax mit dem Propodeum netzartig rauhsulptiert; Abdomen fein punktiert. Der ganze Körper mit den Beinen fein und dicht weisslich behaart, auf Kopf, Rücken und Propodeum länger, auf den Beinen sehr kurz.

Flügel ziemlich stark angeraucht, ohne dunkleren Randsaum. Subcostalzelle sehr lang, fast bis zur Flügelspitze reichend, spitz auslaufend. 3. Radialzelle viel länger als die 2., proximal leicht erweitert, dem Rande des Flügels stark genähert, *M* den Rand fast erreichend; 2. Radialzelle vorn etwas kürzer als hinten, 3. Radialzelle vorn ebenfalls kürzer als hinten, vorn so lang wie die 2. Radialzelle hinten; 1. und 3. Querader schräg, 2. senkrecht gestellt. Pterostigma so lang wie der 3. Abschnitt des *R*. 1. Cubital-Querader fast um ihre Länge postfurcal. Im Hinterflügel mündet die Cubital-Querader weit antefurcal.

Kopf hinter den Augen sehr stark verschmälert, Schläfen ohne Wölbung, stumpf-konisch abgeschrägt. Ocellenstellung spitzwinklig, $POL:OOL=1:2$. Innenränder der Augen fast parallel, nach dem Scheitel zu kaum merklich konvergent; ein Auge = fast 1 Stirnhälfte. Fühler ziemlich schlank, mitten leicht verdickt, 3. Glied etwas länger als Schaft + Pedicellus, 4. Glied = Schaft. Wangen sehr kurz. Clypeus vorn gerade; Maxillartaster sehr lang, ihr 3. Glied = Basalglied + 2. Glied, Borsten des "Kinnbarts" weit vorn stehend, rötlich. Pronotum in flacher Wölbung gegen das Collare abfallend, an den Schultern abgeschrägt, hinten mit breitem, glattem, angedrücktem Saum, der mitten dreieckig erweitert ist, der Endrand flachbögig ausgeschnitten. Postnotum glänzend, gestreift, $\frac{1}{2}$ so lang wie das Postscutellum. Das grob netzartig skulptierte Propodeum mit mittlerer Längslinie.

Beine schlank, Schienen der Hinterbeine fast glatt, Klauen mit deutlichem Zahn, Klauenkamm kaum wahrnehmbar.

Sarawak, am Fusse des Mt. Dulit, am Zusammenfluss von Tinjar und Lejok, 11. ix. 32, in altem Sekundärwald.

CLAVELIINÆ.

Lissocnemis nigricoxis, sp. n.

♀. 15–16 mm. Schwarz; ockergelb sind: die Fühler mit Ausnahme der 6 letzten Glieder, die Beine mit Ausnahme der Hüften und das letzte Segment des Abdomens. Kopf und Thoraxrücken bis ans Ende des Propodeums mit dunkel-goldener haariger Pubeszenz bedeckt; die Pubeszenz der Hüften hell-golden, die des Abdomens sehr fein und kaum bemerkbar, nur die Spitze des Abdomens dunkelgolden und zugleich behaart.

Flügel gelblich, mit leicht angerauchtem Saum. Aderung wie bei *Lissocnemis irrasus* Kohl.

Augen nach rückwärts übergewölbt, Hinterkopf nicht entwickelt, flach, Schläfen nicht vorhanden, wenigstens bei Betrachtung von der Seite nicht zu sehen. Ocellenstellung rechtwinklig, POL fast = OOL ; Innenränder der Augen mit ihren oberen $\frac{2}{5}$ leicht konvergent gegen den Scheitel, ein Auge = 1 Stirnhälfte. 3. Fühlerglied = Schaft + Pedicellus. Wangen linear, Clypeus vorn gerade.

Alles Übrige wie bei *irrasus*, auch das Postnotum sehr kurz und tiefliegend. Propodeum aber fast netzrunzlig, da zwischen den weniger scharf hervortretenden Querrunzeln sich zahlreiche kurze Commissuren befinden

Klauen gespalten.

♂ unbekannt.

1 ♀ von Sarawak aus altem Sekundar-Wald am Tinjar, 8. xi. 32.

PSAMMOCHIRINÆ.

ORIENTANOPLIUS Hpt. (Arkiv. för Zoologie, 1938).

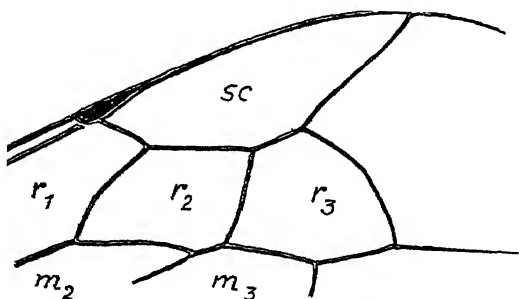
T g. *P. ignobilis* Sauss.

Orientanoplus consimilis, sp. n.

(Die erste Art dieser Gattung, wo mir ausser dem ♀ auch 3 ♂♂ vorlagen.)

♀.—14 mm. Schwarz. Untergesicht und Hüften etwas

Fig 5.



Stück aus dem Vorderflügel von *Orientanoplus consimilis*;
sc=Subcostalzelle, r=Radialzellen, m=Medialzellen.

silbern pubeszent. Behaarung sparlich; Pubeszenz im übrigen schwarz.

Flügel ziemlich dunkel, leicht violett schimmernd. Geäder siehe fig. 5.

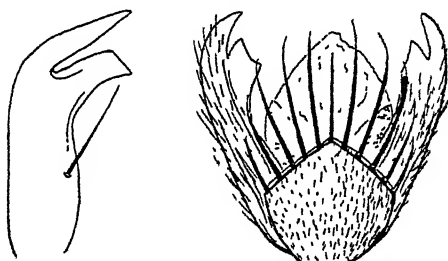
Kopf hinter den Augen stark verschmalert, Schläfen sehr flach abgewölbt. Ocellenstellung spitzwinklig, POL : OOL = 2 : 3. Ein Auge etwas breiter als eine Stirnhälfte; Innenränder der Augen gegen den Scheitel konvergent (Gattungs-Merkmal!). 3. Fühlerglied deutlich länger als Schaft + Pedicellus. Clypeus vorn gerade.

Pronotum bogig (fast stumpfwinklig) ausgerandet. Postnotum etwa so lang wie das Postscutellum, mit kurzem Teilungs-Eindruck in der Mitte des Hinterrandes; Querrunzeln des Postnotums deutlich, vorn 3 oder 4, weiter voneinander entfernt wie die beiden hinteren und vollkommen durchlaufend; nur die beiden hinteren Querrunzeln werden von dem Teilungs-Eindruck geschnitten. Propodeum ohne Skulptur, mit sehr flach angedeuteter Mittellinie.

Klauen mit ziemlich grossem Zahn.

1 ♀ von Sarawak, am Fusse des Mt. Dulit an der Vereinigung der beiden Flüsse Tinjar und Lejok am 18. viii. 32 auf Kulturland.

Fig. 6.



Klauenbildung von *Orientaloplius consimilis* ♂.

♂.—11 mm. Dem ♀ ähnlich, auch in der Kopfbildung, aber: POL: OOL = fast 1:2 (3:5); Clypeus vorn gerade.

Postnotum so lang wie das Postscutellum, seine mittlere Teilung nur hinten angedeutet, seine vorderen Querrunzeln durchlaufend, die 4 oder 5 hinteren Runzeln in die Teilung mündend.

Genitalplatte schmal, schlank zugespitzt, dachförmig gebrochen, aber ohne scharfen Kiel, besonders am Ende lang beborstet.

Klauen gespalten, der Zahn breit gestutzt. Klauenplatte kurz, Kammstrahlen lang und dicht wie beim ♀. Fig. 6.

2 ♂♂ von Sarawak, 7. x. 32 am Tinjar auf einer Waldlichtung. Ein 3. ♂ vom Mt. Kalulong, 1800 Fuss, 6. xi. 32 im Urwald (primitive forest).

Orientanoplius iliacus Cam.

♀.—15–18 mm. Schwarz. Bleigrau pubeszent sind: Gesicht (mehr gelblich!), Hinterkopf, Pronotum vorn und hinten, Thorax \pm . Propodeum, breit die Basis der Abdominal-Tergite. Behaarung spärlich.

Flügel dunkel, leicht violett schimmernd, Geäder fast wie bei *consimilis* m. (Vgl. Fig. 5!).

Kopf hinter den Augen verschmälert, Schläfen sehr kurz, steil abgewölbt, seitlich aber trotzdem deutlich sichtbar. Ocellenstellung rechtwinklig, POL = OOL. Innenränder der Augen mit ihren oberen $\frac{2}{5}$ stark konvergent; ein Auge fast breiter als 1 Stirnhälfte. 3. Fühlerglied deutlich länger als Schaft + Pedicellus. Clypeus mit linearem niedergedrücktem Saum, flachbögig ausgerandet.

Pronotum flachbögig (fast stumpfwinklig) ausgerandet. Postnotum sehr kurz, versenkt, kaum sichtbar. Propodeum mit flacher Längsfurche, ohne sonstige Skulptur, seine hinteren Seiten als abgerundete Ecken etwas vorstehend.

Klauen mit mittellangem Zahn.

Sarawak, Mt. Matang, Mt. Dulit.

Orientanoplius minutidens, sp. n.

♀.—10 mm. Schwarz; Clypeus und Untergesicht silbern pubeszent, ebenso die Seiten des Scutellums, das Propodeum hinten und die Hüften; Abdomen fein grau pubeszent. Behaarung spärlich, nur lang und dicht am Ende des Abdomens.

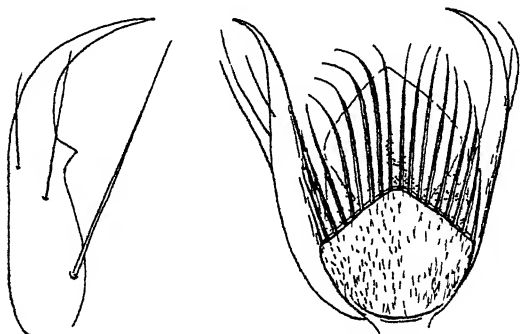
Flügel rauchig getrübt und mit etwas dunklerem Saum. 2. u. 3. Radialzelle hinten etwa von gleicher Länge, die 2. vorn wenig kürzer; 3. Radialzelle nach aussen erweitert, vorn kaum halb so lang als hinten; Subcostalzelle spitz, hinten stumpfwinklig begrenzt, weil 1. u. 2. Abschnitt und 3. u. 4. Abschnitt geradlinig verbunden sind und an der Mündung der 2. Querrader in stumpfem Winkel aufeinander stoßen.

Kopf hinter den Augen stark verschmälert, Schläfen sehr flach, kaum entwickelt. Ocellenstellung spitzwinklig, POL:OOL = 3:4. Innenränder der Augen von ihrer Mitte an gegen den Scheitel deutlich konvergent, Stirn glatt, ein Auge = 1 Stirnhälfte. Fühler schlank, 3. Glied = zweimal Schaft, 4. Glied noch etwas länger

als Schaft + Pedicellus. Clypeus von den Seiten her breit abgerundet, mitten kurz flachbogig ausgerandet.

Postnotum deutlich kürzer als das Postscutellum, mitten mit glatter Teilung; die sehr deutlichen Querrunzeln biegen kurz vor der Teilung flach nach hinten um, berühren die Teilung aber nicht oder kaum. Propodeum ohne erkennbare Skulptur und ohne mittlere Längsfurche.

Fig. 7.

Klauenbildung von *Orientanoplus minutidens* ♀.

Vorderbeine ohne Tarsenkamm. Klauen mit lang ausgezogener Spitze und mit deutlichem kurzem Zahn. Fig. 7.

♂ unbekannt.

1 ♀ vom Mt. Matang bei Sarawak, 1000 Fuss, 22. i. 1914 (leg. G. E. Bryant).

PLAGOMMA, gen. nov.

Kennzeichnend für diese Gattung sind die sehr breiten Augen, der stark eingeeingte Scheitel mit den eng gestellten Ocellen, der flachrunde Bau des Hinterkopfes (stark verschmälert nach rückwärts, kurz, flach ausgerandet) und die schlanken Fühler.

Propodeum mit wenig Längswölbung, ± gleichmässig schräg abfallend.

Flügel mit verhältnismässig langem Pterostigma und schmal zugespitzter Subcostalzelle.

Beine ♀ ohne Tarsenkamm; Klauenkamm mit kurzer Platte und wenigen längeren Kammstrahlen; Klauen mit auffallend langem Zahn, dieser etwas vor der Klauen-Mitte stehend und so lang wie die davor liegende Spitze (Vgl. Fig. 9).

♂ unbekannt.

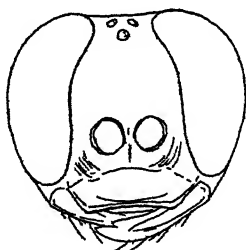
Weil die Seitenkanten des Endsaumes vom Propodeum mit der Metapleural-Naht einen stumpfen Winkel bilden und auf den Hinterschenkeln vor dem Knie 3 feine Dörnchen in Reihe stehen, gehört die Gattung zu den Psammocharinæ und kann hier den *Anoplius*-ähnlichen angeschlossen werden.

T.g. *P. rufifemur*, sp. n.

Plagomma rufifemur, sp. n.

♀.—11.5 mm. Schwarz; hellrot sind die Schenkel der Hinterbeine fast vollständig bis nahe an das Knie;

Fig. 8.



Kopf von *Plagomma rufifemur* ♀.

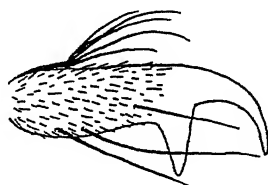
dunkelrot sind die Schenkel der Mittelbeine auf ihrer distalen Hälfte (besonders unterseits), distal die Unterseite der Vorderschenkel und die Unterseite der Schienen. Schienensporen hell. die Sporen der Hinterschienen weiss. Behaarung spärlich. hell; Pubeszenz schwarz. grau schimmernd.

Flügel gelblich getrübt, Adern dunkelbraun, ebenso das Pterostigma, letzteres so lang wie die 2. oder 3. Radialzelle hinten. Subcostalzelle spitz auslaufend; 2. und 3. Radialzelle hinten von gleicher Länge, die 2. vorn nur wenig kürzer, die 3. vorn nur $\frac{1}{2}$ so lang wie hinten;

3. Radial-Querader stark nach aussen gebogen, fast winkelig gebrochen.

Kopf hinter den Augen stark verschmälert, Scheitel flachbogig ausgehöhlt, Hinterkopf sehr kurz, Schläfen seitlich von nur $\frac{1}{3}$ der Augendicke. Ocellenstellung spitzwinklig, POL = OOL. Innenränder der Augen gegen den Scheitel stark konvergent, über ihrer Mitte am stärksten, am Scheitel kaum halb so weit voneinander entfernt als am Clypeus; ein Auge mitten breiter als 1 Stirnhälfte (Fig. 8). 3. Fühlerglied viel länger als Schaft + Pedicellus, etwa zweimal so lang wie der Schaft, 4. Glied auch noch etwas länger. Fühler also lang und dünn. Clypeus so breit wie das Untergesicht, mit niedergedrücktem, flachem Saum, vorn flachbogig ausgerandet. Wangen vorn kurz, nach rückwärts stark verlängert.—Pronotum kurz, sehr flach stumpfwinklig ausgeschnitten, mit breitem, niedergedrücktem Saum. Scutellum und Postscutellum gewölbt; Postnotum so lang

Fig. 9.



Klaue eines Hinterfüsses von *Plagomma rufifemur* ♀.

wie das Postscutellum, seine Querstreifen in der Mitte bogig nach vorn ziehend, wodurch mitten vor dem Propodeum eine glatte stumpf-dreieckige Fläche entsteht. Propodeum nur vorn leicht gewölbt, im ganzen gleichmässig schräg nach rückwärts abfallend. Abdomen schlank, gegen sein Ende bauchwärts zusammengedrückt (komprimiert).

Vorderbeine ohne Tarsenkamm; Klauen mit auffallend langem Zahn (Fig. 9). Klauenkamm mit kurzer Platte und langen Kammstrahlen.

♂ unbekannt.

1 ♀ von Sarawak, am Zusammenfluss von Tinjar und Lejok mittels Lichtfalle erbeutet am 25. ix. 32.

Bei dem einzigen mir vorliegenden Stück war leider die gesamte Pubeszenz von Kopf und Thorax verklebt und erschien deshalb schwarz.

Trotz des schmalen Clypeus und der weissen Schienenspornen ist die Art keine *Calicurgine* (vgl. Nachsatz zur Gattungs-Diagnose!).

V.—*The Eocene Insects of the Ardtun Beds, Isle of Mull, Scotland.* By FREDERICK E. ZEUNER, Department of Geology, British Museum (Natural History).

[Plate I.]

INTRODUCTION.

The interbasaltic plant-beds of Ardtun Head on the Isle of Mull have yielded a small but interesting fauna of insects which is described and discussed in the following pages. The flora has been repeatedly investigated and the age of the fossiliferous horizons discussed. They were formerly considered as Miocene, chiefly under O. Heer's influence, but they are now regarded as probably of early Eocene age. Summaries of the history of investigation, the flora itself, and the literature on the Ardtun Beds have been published by Seward and Holttum (1924) and by Seward, Edwards, and Simpson (1938). A monograph of the flora, by Sir Albert Seward and Mr. W. N. Edwards, is in preparation, and will be published by the Trustees of the British Museum (Natural History).

The first report on fossil insects enclosed in these beds is by Gardner (1887), who figured an elytron of a beetle and a hind-wing which he believed to be cercopid, though it obviously belongs to the Cicadinæ. His specimens cannot now be traced. In 1921 Cockerell described three elytra of beetles, and named one of them (*Carabites scoticus* Cock.). The description was republished in Seward and Holttum's paper (1924). Mr. W. N. Edwards has been able to trace two further references to fossil insects, by Gregory (1927, p. 205) and by Gregory and Barrett (1931, p. 206), mentioning a beetle with Upper

Cainozoic affinities. This, I am inclined to think, is Cockerell's species, since he compares it with a Recent genus. There is, however, just a chance that Gregory and Barrett had before them some other specimen which has not yet been described.

Most of the specimens described in the present paper were collected by Messrs. R. P. Tripp and W. N. Croft on a joint excursion in 1938. This material is now in the Department of Geology of the British Museum (Natural History). One beetle elytron (no. 832) has been borrowed from the Koch Collection of Glasgow University. The three elytra of beetles mentioned by Cockerell are in the University of Cambridge.

I am greatly indebted to Mr. W. N. Edwards and Mr. W. N. Croft for information regarding the Ardtun Beds in general and for permission to make use of their notes. Mr. W. E. China spent much of his time in discussing the classification of the Homoptera. Dr. F. W. Edwards helped me with regard to the Diptera, and Drs. K. G. Blair, H. E. Hinton, and F. van Emden suggested possible affinities for the beetle elytra. Mr. M. E. Mosely supplied the photograph of the larval case of a Recent *Phryganea*. To all these gentlemen my sincere thanks are due.

DESCRIPTIONS.

Order ODONATA.

ODONATORUM gen. et sp. indet.

Specimen.—British Museum (Natural History), Tripp Coll., In. 37269.

Remarks.—The fragment of a large wing of a dragon-fly, near the pterostigma. Preserved portion 7.5 mm. long. Not determinable.

Order SALTATORIA.

Suborder ENSIFERA.

Family Gryllacrididæ.

Subfamily PALÆOREHNIINÆ.

1937. *Palæorehniinæ* Zeuner, Proc. R. Ent. Soc. London, (B) vi. p. 154.

1939. *Palæorehniinæ* Zeuner, Foss. Orth. Ensifera, p. 122.

Genus PALÆOREHNIA Cockerell.

1908. *Palæorehnia* Cockerell, Ent. News, xix. p. 126.1939. *Palæorehnia* Cockerell, Zeuner, Foss. Orth. Ensifera, p. 123.*Palæorehnia scotica* Zeuner. (Text-fig. 1.)1939. *Palæorehnia scotica* Zeuner, Foss. Orth. Ensifera, p. 126.
pl. xlv. fig. 5, pl. l. fig. 3, pl. lxxii. fig. 5.*Holotype*.—British Museum (Natural History), Croft Coll., In. 37251, with counterpart.*Remarks*.—This interesting Gryllacridid belongs to a genus represented in the Miocene of Florissant, Colorado.

Order COLEOPTERA.

Eight species of beetles are known from the Ardtun Beds. None of them is determinable, though one has been named by Cockerell.

COLEOPTERORUM gen. et sp. indet. 1 (? Buprestidæ).
(Text-fig. 3.)

1887. Elytron of a beetle, Gardner, Quart. J. Geol. Soc. London, xliii. p. 299. pl. xiii. fig. 8.

Specimen.—Cannot be traced.*Parts known*.—Fragment of elytron.*Measurements* (taken from figure).—Length of fragment 31 mm.

Description.—No description has been given, but Gardner's figure is said to be natural size. The basal portion of the elytron is not preserved. From the figure it appears to be the left elytron of a large beetle, fairly pointed at the apex and with a constriction in the outer margin at about one-third from the base. A number of striae are present.

Remarks.—Shape and size suggest the family Buprestidæ.*Carabites scoticus* Cockerell. (Text-fig. 4.)1921. *Carabites scoticus* Cockerell, Canad. Entomologist, liii. p. 22, fig. 28.1924. *Carabites scoticus* Cockerell, in Seward and Holttum, Mem. Geol. Surv. Scotland, p. 71.*Holotype*.—Cambridge University Coll.*Parts known*.—Elytron.*Measurements*.—Elytron 5 mm. long, 2 mm. broad.

Description (combined from Cockerell 1921 and 1924).—Apex obtuse. Inner basal corner rectangular. Margins

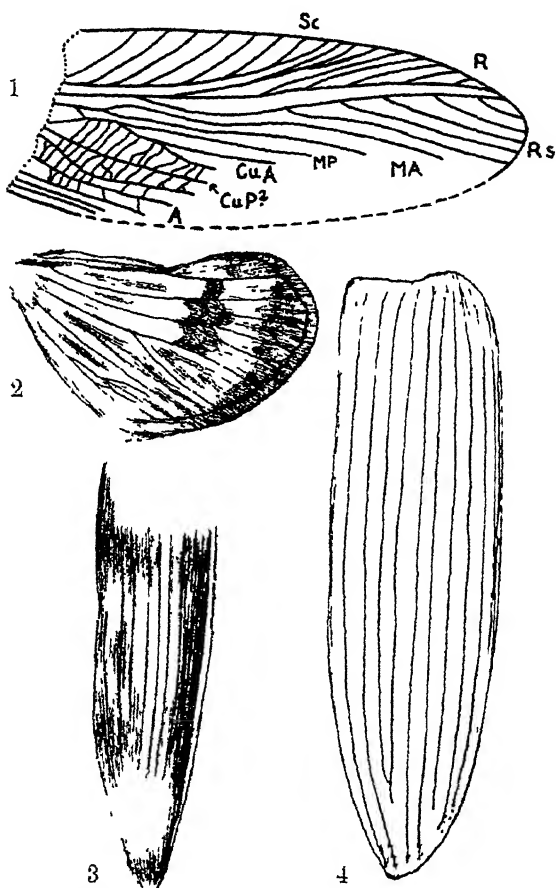


Fig. 1.—*Palaeorehnia scotica* Znr., elytron. Holotype, In. 37251. $\times 3$. After Zeuner, 1939.
Fig. 2.—*Platyleura* sp. indet., hind wing. $\times 2$. After Gardner, 1887.
Fig. 3.—Elytron of beetle, ? Buprestidæ. $\times 2$. After Gardner, 1887.
Fig. 4.—*Carabites scoticus* Cock., elytron. Holotype. $\times 17$. After Cockerell, 1921.

very slightly convex except at apex and outer base. Ten striae, not counting the inner absolutely marginal

one; striæ weakly and closely punctate under a high power, but in general effect sharp; outermost stria marginal except near base; third and fourth striæ (counting from inner margin) joining at a distance from the apex about five times as great as the distance between the striæ, with a short appendiculation beyond; seventh stria ending before the sixth or eighth.

Remarks.—Cockerell says that this elytron is “in general much like *Anchomenus fuliginosus* Pz.,” a Recent British species of the Carabidæ.

COLEOPTERORUM gen. et sp. indet. 2.

1921. Cockerell, *Canad. Entomologist*, liii. p. 22.

1924. Cockerell, in Seward and Holtum, *Mem. Geol. Surv. Scotland*, p. 71.

Specimen.—Cambridge University Coll.

Parts known.—Elytron.

Remarks.—Mentioned by Cockerell as being at least very close to *Carabites scoticus* Cock.

COLEOPTERORUM gen. et sp. indet. 3 (? Curculionidæ).

1921. Apparently a weevil, Cockerell, *Canad. Entomologist*, lxi. p. 22.

1924. Apparently a weevil, Cockerell, in Seward and Holtum, *Mem. Geol. Surv. Scotland*, p. 71.

Specimen.—Cambridge University Coll.

Parts known.—Elytron.

Measurements.—About 3 mm. long.

Description.—“Weakly striate.”

Remarks.—According to Cockerell apparently a weevil.

COLEOPTERORUM gen. et sp. indet. 4. (Pl. I. fig. 8.)

Specimen.—Glasgow University. Koch Coll., no. 832.

Parts known.—Elytron.

Measurements.—Length 7.3 mm., maximum width 2.6 mm.

Description.—Elytron elongate, with nine striæ each consisting of numerous, somewhat elongate punctures. (Pl. I. fig. 8.)

Remarks.—This elytron is so little characteristic that suggestions as to its affinities are almost useless. Similar elytra occur in the Tenebrionidæ and many other families.

COLEOPTERORUM gen. et sp. indet. 5 (? Elmidæ).
(Pl. I. fig. 5.)

Specimen.—British Museum (Natural History), Tripp Coll., In. 37278, with counterpart.

Parts known.—Elytron.

Measurements.—Elytron 2·8 mm. long and 1·2 mm. wide.

Description (Pl. I. fig. 5).—This elytron is widest at about two-thirds from the base. It carries sharp, thin ridges separated from one another by two rows of fairly large, circular punctures.

Remarks.—The type of sculpture shown by this elytron occurs in the Elmidæ—for instance, in *Stenelmis* Duf.—according to Dr. H. E. Hinton. The Elmidæ are an aquatic family.

COLEOPTERORUM gen. et sp. indet. 6 (? Dryopidæ).
(Pl. I. fig. 6.)

Specimen.—British Museum (Natural History), Croft Coll., In. 37246.

Parts known.—Fragment of elytron, apex missing.

Measurements.—Fragment 2·2 mm. long.

Description (Pl. I. fig. 6).—This elytron has about ten rows of punctures, slightly sunken in striæ. The whole surface, in addition, is covered with small punctures situated on minute tubercles.

Remarks.—Dr. H. E. Hinton informs me that this kind of structure occurs in the Dryopidæ, as, for instance, in *Helicus* Er. The Dryopidæ are aquatic and found in ponds and lakes.

COLEOPTERORUM gen. et sp. indet. 7 (? Colydiidæ).
(Pl. I. fig. 7.)

Specimen.—British Museum (Natural History), Tripp Coll., In. 37276, with counterpart In. 37277.

Parts known.—Elytron.

Measurements.—Elytron 3·7 mm. long and 1·1 mm. wide.

Description (Pl. I. fig. 7).—Of almost equal width throughout, slender. There are about ten rows of elongate punctures sunken in furrows and separated by flat ridges.

Remarks.—The arrangement of alternate flat ridges and furrows containing the punctures is, according to

Dr. H. E. Hinton, reminiscent of the Colydiidæ, a family of bark-beetles.

Order HEMIPTERA.

Suborder HOMOPTERA.

Family Cicadidæ.

Subfamily CICADINÆ.

Platypleura sp. indet. (Text-fig. 2.)

1887. Cercopid insect, Gardner, Quart. J. Geol. Soc. London, **xliii.**
p. 299, pl. **xiii.** fig. 9.

Holotype.—Cannot be traced.

Parts known.—Hind-wing.

Measurements (taken from figure).—Length 23 mm.

Description.—In size, venation, and pattern identical with certain species of the Recent genus *Platypleura* Ann. & Serv. 1843, except that the cross-veins closing the two discoidal cells form wider angles in the fossil. This character needs confirmation, but, unfortunately, the type appears to be lost.

Remarks.—It is most regrettable that this specimen cannot be traced, since it would certainly offer characters sufficient for a specific determination. The marginal dark band extends right to the edge of the wing, as it does in the Recent species *P. ciliaris* L. and *P. hilpa* Walk., both from Indo-China. It tapers out rapidly, however, about two-thirds down the hind margin. The pre-apical spot reminds one more of the South African species *P. hirta* Karsch and *P. wahlbergi* Stål, but in these the edge of the wing outside the submarginal vein is colourless. It was Mr. W. E. China who suggested that this fossil might be related to *Platypleura*.

Family Cercopidæ.

Eocercopis maculata, gen. et sp. n.

(Text-fig. 5 ; Pl. I. fig. 3.)

Diagnosis.—A Cercopid with comparatively broad tegmina, obliquely truncate apex, a well-developed, strongly curved *R*, a very long medio-cubital fork, and with apical cells.

Holotype.—British Museum (Natural History), Tripp Coll., In. 37731.

Parts known.—Tegmen complete except clavus. Body showing no details.

Measurements.—Tegmen 9·7 mm. long; greatest width from fore margin to clavus suture 3·8 mm. Length of body 12·8 mm., width 6·4 mm.

Description (text-fig. 5).—The venation of the tegmen resembles that of several Recent genera of Cercopidæ, especially of the Aphrophorinæ, but it cannot be matched with any one of them.

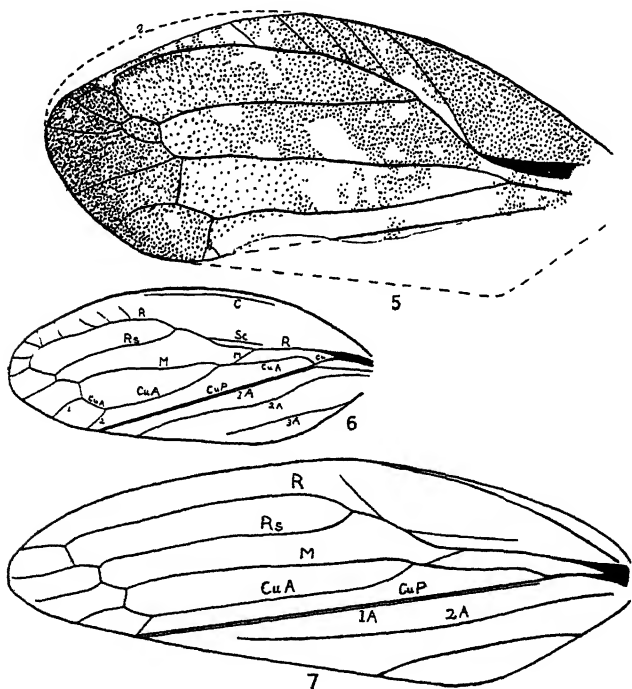


Fig. 5.—*Eocercopis maculata*, gen. et sp. n., tegmen. Holotype, In. 37731. $\times 8$.

Fig. 6.—*Peuceptyelus indentata* Uhler, tegmen. Recent, Japan. $\times 8\cdot5$.

Fig. 7.—*Aphrophora mirica* Edw., tegmen. Recent, Austria. $\times 8\cdot8$.

R is strongly bent upwards near the base, and the pre-radial portion of the tegmen is very wide. This portion is traversed by several pectinate branches of *R*. The root of *Rs* lies at about one-third of the wing-length

from the base. Distally *Rs* is connected with *R* by a terminal cross-vein which forms a loop. The apical portion of the fore margin slants towards the apex in a somewhat unusual way and approaches the radial loop very closely. If this feature is genuine it would provide an excellent generic character; yet it is just possible (though not probable) that a portion of the fore margin is missing.

The radio-median area is very broad, owing to the upward bend of *R*. *M* separates from *CuA* very close to the base.

There are five apical cells and one small subapical cell.

The clavus is not preserved.

The whole surface of the tegmen is strongly punctate, as in *Aphrophora* and *Peuceptyelus*. The colour-pattern consists of irregular light patches on a dark background, the light shade prevailing near the hind margin.

Remarks.—The venation of this tegmen is clearly cercopid. About 80 species of Tertiary Cercopidæ have been described, but the fossil from Mull does not agree with any of them, nor can it be placed in one of the Recent genera. The venation, punctation, and colour-pattern approach it to *Aphrophora* Germ. (text-fig. 7) and *Peuceptyelus* Sahlb. (text-fig. 6), two closely allied genera of the Aphrophorinæ, the former widely distributed in Europe and other parts of the Old World, the latter from Japan. These and allied genera comprise the spittle-insects the larvæ of which produce the well-known cuckoo's spit.

Family Jassidæ.

Subfamily BYTHOSCOPINÆ.

Maleojassus primitivus, gen. et sp. n.

(Text-fig. 8; Pl. I. fig. 3.)

Diagnosis.—A Jassid related to Bythoscopinæ like *Stonasia* and *Austroagalloides*. Venation resembling that of *Stonasia*, except that *Rs* is not broken where it is met by *M*₁ and *M* is almost straight.

Holotype.—British Museum (Natural History), Croft Coll., In. 37250.

Parts known.—Tegmen, with clavus partly preserved.

Measurements.—Tegmen 7.2 mm. long (part of base missing); greatest width from fore margin to clavus suture 2.5 mm.

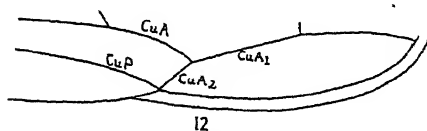
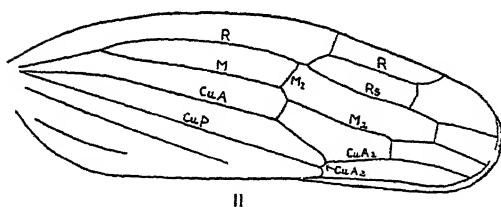
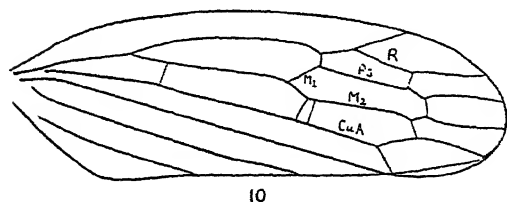
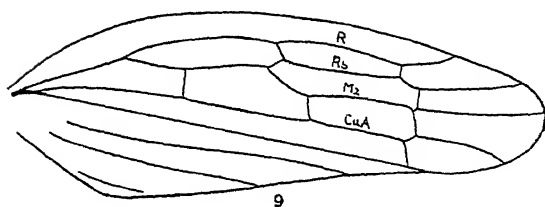
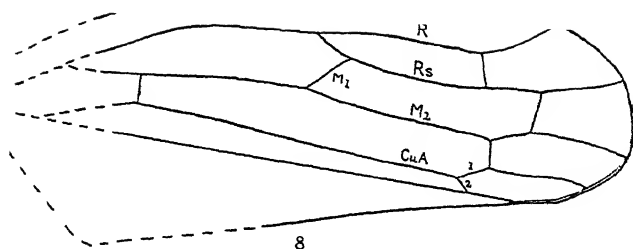


Fig. 8.—*Maleojassus primitivus*, gen. et sp. n., tegmen. Holotype, In. 37250. $\times 10.3$.

Fig. 9.—*Stonasla undulata* White, tegmen. Recent, St. Helena. $\times 10$.

Fig. 10.—*Austroagalloides*, sp. indet., tegmen. Recent, Leura, Australia. $\times 10$.

Fig. 11.—*Tettigoniella viridis* (L.), tegmen. Genotype. Recent, Europe. $\times 10$.

Fig. 12.—*Tettigoniella ruficeps* var. *trilineata* Fowl., distal portion of hind margin of tegmen, showing the branching of the anterior cubitus and the foldable portion called the appendix between the distal ends of CuP and CuA₁. Recent, Central

Description (text-fig. 8).—The venation closely resembles that of certain genera of the Bythoscopinæ, such as *Stonasla* White (text-fig. 9) from St. Helena, or *Austroagaloides* Evans (text-fig. 10) from Australia. These genera are related to the cosmopolitan tribe Agalliini.

The tegmen of *Maleojassus primitivus* is comparatively broad and the apex is much rounded. The peripheric vein in the lower apex is almost marginal.

R is undivided. *Rs* leaves *R*, halfway between the base and the apex, in a smooth curve; it is not angulate where it is met by *M*₁. There is one cross-vein in the radio-radiosectorial area. *M* separates very early from *R*. *M*₁ joins *Rs* as usual, but the radio-median cell is exceptionally long. *M* is almost straight, and deviates from its course only in the apex, where one cross-vein connects it with *Rs* and another with *CuA*₁. The medio-cubital area contains two cross-veins only, one near the base of *M* and one cutting off an apical cell.

CuA bears the usual apical fork. The angle between *CuA*₁ and *CuA*₂ is acute, and the latter branch is not reversed as it is in certain specialized Jassidæ, especially the Tettigoniellinæ (text-figs. 11, 12). *CuA*₂ is short and straight, it joins *CuP* before the latter reaches the hind margin.

The venation of the clavus is badly preserved.

The surface of the tegmen is smooth, the veins stand out, and the membrane appears to have been thin. The whole tegmen is of a greenish-golden colour, which is evidently structural. This might be the original colour of the tegmen, but more probably it is due to changes in the structure of the chitin caused by fossilization. Metallic hues are not common in the Jassidæ, and mostly of the steel-blue variety.

Remarks.—The Jassidæ are a very large family. I have therefore devoted much time to a study of the Recent genera and to the problem of the identification of the subfamilies by means of venational characters. The results, which are not yet satisfactory in every respect, cannot be set forth in this context, since this would imply an extensive discussion of the classification of the Jassidæ, which is at present in a state of flux.

Regarding the systematic position of the fossil form from Mull, however, I was able to eliminate all Jassidæ

except certain Bythoscopinae related to the Agalliini (which, however, are rather smaller in size). The genus *Stonasla* White (text-fig. 9) is very close to the fossil in the venation in general, in the marginal position of the peripheral vein in the lower apex, in the absence of a branch of *R*, and in the primitive structure of the apical fork of the anterior *Cu*. The distinguishing characters are :

	<i>Stonasla</i> White.	<i>Maleojassus</i> , gen. nov.
Wing-shape	more slender.	broad and rounded.
<i>Rs</i>	angulate.	smoothly curved.
<i>R-M</i> cell	short.	long.
<i>M</i>	distorted by cross-veins.	almost straight.
<i>M-Cu</i> cross-veins . . .	3.	2.

These characters are sufficient to erect a new genus. Some of them are observed in other genera also, as, for instance, the absence of a third medio-cubital cross-vein (in *Nehela ornata* Dist., *Agalliopsis majesta* Oman, *Agallia puncticeps* Germ., *Agallia venosa* Fall.). The absence of a branch connecting *R* with the fore margin is common to *Stonasla* and *Maleojassus*, and also the much smaller *Agallia*. In other related genera, such as *Austroagalloides* Evans (text-fig. 10), this radial branch is present.

Three of the characters mentioned of *Maleojassus* may be regarded as very primitive. The first is the smooth curve of *Rs* near its root ; there is no angle where *M*₁ fuses with it. The second is the considerable length of the radio-median cell, due to an early separation of *M* from *R*. The partial fusion of *M* with *R* is a character of the family, and, considering the history of Homoptera in general, a definite specialization. A restriction of the fusion to the base of the tegmen, therefore, is likely to be a primitive feature.

The third primitive character is the absence of any specialization of the fork of the anterior cubitus. There is no indication of the venation becoming adapted to a folding of the lower apex (the "appendix"), which is so conspicuous in other Jassidæ (most typical in the Tettigoniellinæ, text-figs. 11, 12).

In short, *Maleojassus* is a primitive Jassid related to the Agalliini among the Bythoscopinae.

Note on the nature of the vein which separates the clavus from the remainder of the tegmen.—This vein, which is always very straight and connected with a narrow fold,

coalesces with *CuA* near the base. Following Comstock and Needham, most entomologists have interpreted it as the first analis, whilst palæo-entomologists, like Martynov and Tillyard, call it the posterior cubitus. The structure of the cubitus of the Hemiptera is similar to that of the orthopteroid insects, in particular to the Saltatoria, with their less highly specialized venation. If one considers the Hemiptera as descended from the orthopteroid stock, the vein in question is, *per analogiam*, *CuP*, and it has been designated as such in the present paper. The true *1A* is often identifiable also; it is so close to *CuP* that it cannot be shown correctly in most of the drawings.

Order TRICHOPTERA.

Family Phryganeidæ.

Spec. cf. *Phryganea grandis* L. (Pl. I. fig. 1.)

Specimen.—British Museum (Natural History) Coll., In. 37732, with counterpart.

Parts known.—Portion of a larval case.

Measurements.—Fragment 13 mm. long, 7 mm. wide.

Description (Pl. I. fig. 1).—The fragment is built up of $2\frac{1}{2}$ rows of pieces of grass or *Carex*, three in a row, and in a slightly spiral arrangement. Each piece measures about 5 by 2.5 mm., and its corners are rounded.

Remarks.—This specimen resembles in every respect certain larval cases of the Recent *Phryganea grandis* L. (Pl. I. fig. 2), but this does not imply real specific identity. It is interesting to note that this type of larval case of a caddis-fly occurs as early as in the Eocene.

Order DIPTERA.

Suborder NEMATOCERA.

Family Bibionidæ.

Plecia undans, sp. n. (Text-figs. 13, 14.)

Diagnosis.—A *Plecia* with wings about 10 mm. long, dark along the costal margin. Anterior branch of *Rs* very long for a *Plecia*, originating well proximally of the end of *R*, forming a more or less distinct double curve, but not parallel to the posterior branch of *Rs*.

Holotype.—British Museum (Natural History), Tripp Coll., In. 37274.

Paratypes.—Same collection. In. 37266 with counterpart In. 37267, and In. 37268 *b*.

Parts known.—Wings only.

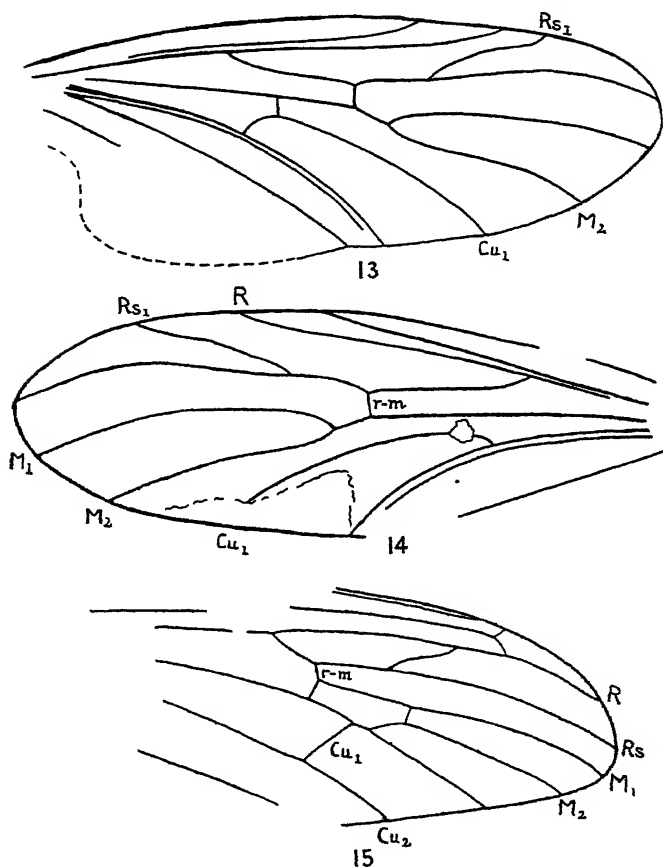


Fig. 13.—*Plecia undans*, sp. n. Holotype, In. 37274. $\times 8.3$.

Fig. 14.—*Plecia undans*, sp. n. Paratype, In. 37266, with certain details transferred from the counterpart, In. 37267. $\times 8.2$.

Fig. 15.—*Stibadocerites europæus*, gen. et sp. n., apical half of wing. Holotype, In. 37268 *a*. $\times 8.9$.

Measurements.—Holotype : length 10.3 mm., maximum width 3.6 mm. Paratype, In. 37266 : length 10.8 mm., maximum width 4.1 mm. Paratype, In. 37268 *b* : length 10.8 mm., maximum width 4.0 mm.

Description (text-figs. 13 and 14).—The holotype and paratypes agree closely with certain Recent species of *Plecia* Wied. and *Penthetria* Meig.

The venation is identical with that of the Recent *Plecia aterrima* Brun., with the exception of the anterior branch of *Rs*. This branch is in the fossil very long for a *Plecia*, and its root lies so much proximally of the end of *R* that *R* extends over at least half the length of Rs_1 . The figures will make this clear.

The apex of the wing tapers slightly. A zone between the fore margin and the *Rs* and *M* is darkened over the whole length of the wing.

The holotype and paratypes differ in certain minor details. The holotype has a comparatively short *Rs*, whilst in both paratypes this vein is longer (? sexual difference). The paratype In. 37266 is of a darker colour than the two other specimens. Such differences, however, are frequent in Recent species of Bibionidæ.

Remarks.—The anterior branch of the *Rs* plays an important part in the definition of certain genera of Bibionidæ. Duda regards as *Penthetria* those species in which Rs_1 begins at or close to the cross-vein *r-m*. Rs_1 being long and parallel to Rs_2 . In *Plecia*, however, Rs_1 is much shorter and steeper, forming a wide angle with Rs_2 , and its root is far removed from *r-m*. In the fossil form Rs_1 is not parallel to Rs_2 and its root is distant from *r-m*.

For this reason it has to be regarded as a *Plecia*. It shows, however, a distinct tendency towards *Penthetria* in the unusual length of Rs_1 and the proximal position of its root relative to the end of *R*. It resembles *Penthetria atra* Macq. and *P. nigerrima* Bell., but in these Rs_1 is more distinctly parallel to Rs_2 .

Thus *Plecia undans*, sp. n., is to some extent intermediate between *Plecia* and *Penthetria*.

Family Tipulidæ.

Subfamily CYLINDROTOMINÆ.

Stibadocerites europæus, gen. et sp. n. (Text-fig. 15.)

Diagnosis.—Cylindrotominæ with the venation of *Stibadocerella* Brun., but *Sc* very long and basal portion

of *Rs* exceptionally short. Terminal branches of all veins in the apex very long.

Holotype.—British Museum (Natural History), Tripp Coll., In. 37268 *a*.

Parts known.—Apical portion of wing.

Measurements.—Width 3.3 mm.; length of *Rs* 5.4 mm. Total length of wing probably about 12–13 mm.

Description (text-fig. 15).—Outline of wing (so far as preserved) and venation as in *Stibadocerella* Brun., differences being found in the lengths of the veins and the positions of the branching points only.

Sc, with *Sc*₁ and *Sc*₂, is extraordinarily long and almost reaches the apex. The root of *Rs*, therefore, appears to lie far proximally of the end of *Sc*. The portion of *Rs* between its root and the cross-vein *r-m* is very short, measuring less than one-sixth of the total length of *Rs*. In the Recent *Stibadocerella albitarsis* de Meij. and *Stibadocerella pristina* Brun. this proportion is about one-third.

The fore branch of *Rs* originates far apically of *r-m*; it is oblique and forms a double wave. It joins *R* proximally of the end of *Sc*. *R* itself is fairly straight and slightly bent downwards in the apex.

The intramedian cell is long and narrow.

All veins distally of the median cell are exceptionally long, but the base of *Rs* is unusually short. This suggests that in this new genus the apex was much extended in a longitudinal direction at the expense of the basal portion of the wing.

Remarks.—The close affinity of this fossil to the *Stibadocera* group among the Cylindrotominæ is evident. Alexander divided the group into two divisions, depending on the position of *r-m* in relation to the fork of *Rs*. The fork is close to the cross-vein in *Stibadocera* and *Stibadocerodes*, but in *Stibadocerella* and *Stibadocerina* it is much more apical. The fossil genus agrees with this second group.

Stibadocera and *Stibadocerella* are known from Malaya, *Stibadocerodes* from Australia, and *Stibadocerina* from Chile. This wide distribution and the small number of species suggest a considerable geological age of the group, to which the Eocene *Stibadocerites* from Scotland has now to be added.

INSECTA INCERTÆ SEDIS.

There are eight specimens in the British Museum Collection which cannot be assigned to any order, being preserved in a very fragmentary state. Some may not be insects at all. These specimens bear the following numbers:—

In. 38081–38082, Croft. Coll.

In. 37265, Tripp Coll.

In. 37247, Croft Coll.

In. 37248–37249, Croft Coll. (? abdomen of a fly).

In. 37270, Tripp Coll. (? dipterous wing).

In. 37272, Tripp Coll.

In. 37275, Tripp Coll.

In. 37271, Tripp Coll.

GENERAL REMARKS AND CONCLUSIONS.

The insect fauna of the Ardtun Beds of Mull comprises, as far as known at present, 1 dragon-fly, 1 long-horned grasshopper, 8 beetles, 3 cicadas, 1 caddis-fly, 2 gnats, making 16 species in all. To these may be added the 8 underterminable specimens.

The assemblage is of a mixed character and does not indicate any particular type of environment. The larvæ of dragon-flies and caddis-flies live in water, and the occurrence of a larval case of a caddis-fly suggests that the deposit was formed under water. One or two of the beetles may have been aquatic. The other insects are purely terrestrial. The gnats may have required some moisture for the development of their larvæ, the fully-winged Gryllacrididæ are now characteristic of tropical forests, and the cicadas require vegetation, but which kind one cannot tell. In short, a biological analysis of the fauna produces no new results, and the flora provides an infinitely better means of reconstructing the environment of Eocene Mull.

A geographical analysis of the fauna is more interesting. Though only the few generically determinable specimens can be taken into consideration, a somewhat curious picture of the present distribution of the nearest relatives of the Mull insects is obtained. It is summarized in the following list:—

<i>Palæorhina</i>	Miocene of Colorado, U.S.A.
<i>Platyleura</i>	Indo-China and South Africa.
<i>Ecercopsis</i>	Old World.

<i>Maleojassus</i>	St. Helena, Australia.
<i>Plectia</i>	Holotropical.
<i>Stibadocerites</i>	Malaya, Australia, Chile.

Tropical and southern connections predominate. Though the number of comparable forms is small, affinities to Recent forms of the Southern Hemisphere occur in three cases (out of six). Not counting *Palæorehnia*, an extinct genus (of a tropical family) which occurs in the Miocene of Colorado as well as in the Eocene of Mull, only one out of the remaining five forms is temperate rather than tropical in the distribution of its living relatives (*Eocercopis*). Seward and Edwards (1938) found that the flora of Mull is most closely allied to that of south-east Asia among the Recent floral areas. Thus the insects differ from the plants in this respect.

Tropical relationship is very frequent in insect faunas from Tertiary beds. A geographical analysis of several well-studied faunas of fossil insects has shown that in the Miocene as in the Eocene tropical connections predominate, but that in the Eocene a North American component is fairly prominent also. Besides, there are always a number of forms whose Recent relatives are Palæarctic and fond of temperate conditions (Zeuner, 1931). This does not mean, however, that the climate was temperate; adaptation to new climatic conditions has taken place on a large scale during and since the Tertiary.

The Mull fauna is too small to allow of determining its age within the Tertiary. The predominance of forms whose Recent relatives live in very distant regions is suggestive of Eocene rather than late Tertiary.

All forms which I have been able to study are so closely related to certain Recent forms that the Tertiary age of the fauna, and therefore of the deposit, is to be regarded as certain.

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EXPLANATION OF PLATE I.

- Fig. 1. Portion of larval case of a caddis-fly, cf. *Phryganea grandis* L., In. 37732. $\times 3$.
- Fig. 2. Larval case of *Phryganea grandis* L., Recent, natural size. Compare with fig. 1.
- Fig. 3. *Eoecercopis maculata*, gen. et sp. n., tegmen. Holotype, In. 37731. $\times 3$.
- Fig. 4. *Maleojassus primitivus*, gen. et sp. n., tegmen. Holotype, In. 37250. $\times 5$.
- Fig. 5. *Coleopterorum*, gen. et sp. indet. 5, cf. Elmidae. In. 37278. $\times 10$.
- Fig. 6. *Coleopterorum*, gen. et sp. indet. 6, cf. Dryopidae. In. 37276. $\times 12$.
- Fig. 7. *Coleopterorum*, gen. et sp. indet. 7, cf. Colydiidae. In. 37276. $\times 10$.
- Fig. 8. *Coleopterorum*, gen. et sp. indet. 4. Glasgow University, no. 832. $\times 5$.

VI.—Some *Dichograptids* of the Tremadocian and Lower Ordovician. By O. M. B. BULMAN, Sc.D., A.R.C.S., F.R.S., Sedgwick Museum, Cambridge.

[Plate II.]

I. INTRODUCTION.

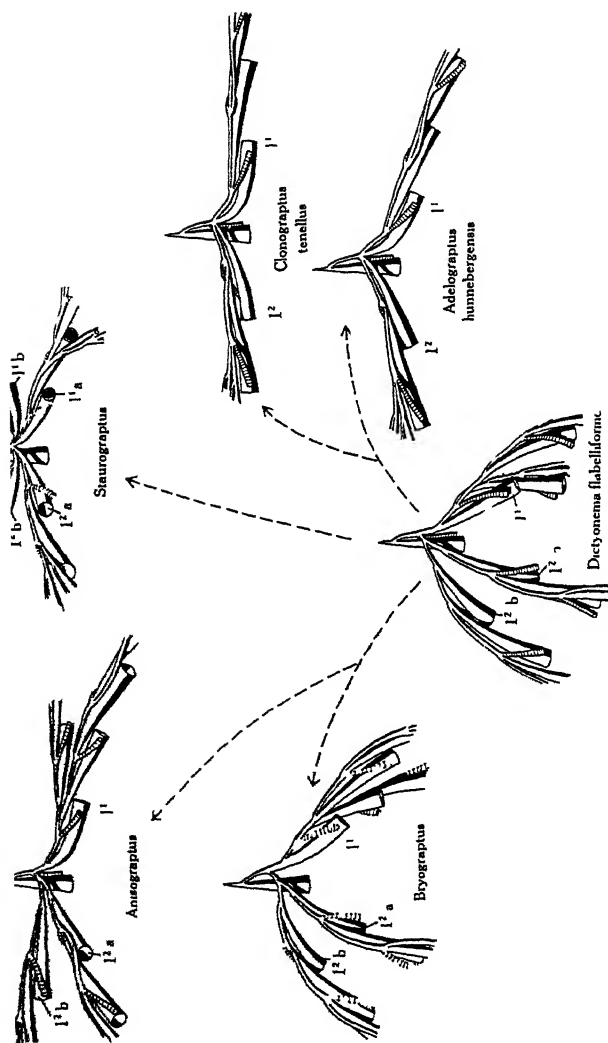
The Tremadocian was a period of great importance in graptolite evolution, for it was then that the Graptoloidea originated and that some of the main lines of their subsequent development were laid down. Unfortunately our knowledge of the graptolite faunas of this period is still very incomplete, though three papers in comparatively recent years have made valuable contributions. In 1925 Mosen described a graptolite fauna from the *Ceratopyge* Shales of the Oslo district, which included the earliest didymograptids yet known, *D. kiseri* and *D. norvegicus*, a *Tetragraptus* (?), *T. kolderupi*, a new genus *Triograptus*, and various bryograptids. *Triograptus* was

perhaps the most remarkable of these forms, for the three stipes of which the rhabdosome consists appeared to originate independently in the sicula, so that the genus is in no way intermediate between *Tetragraptus* and *Didymograptus*. In 1929 Stubblefield made a beautifully detailed study of *Clonograptus tenellus*, its variety *callavei*, and *Bryograptus hunnebergensis*, proving in all the presence of budding-individuals and bithecæ, and demonstrating the close relation of these forms to *Dictyonema flabelliforme*. Lastly, in 1937, Ruedemann described a fauna from Matanne, Quebec, consisting of a *Dictyonema*, Monsen's genus *Triograptus*, and a new genus *Anisograptus*, a horizontal multiramous dichograptid in which there are three primary stipes diverging from the sicula.

In the following pages I have described several new species of *Anisograptus* (which, together with *Bryograptus*, s. str., seems rather characteristic of the Upper Tremadocian), and have at the same time attempted to review the known species of these and allied Tremadocian genera, many of which range up into the basal Ordovician. Some of the material described was collected in 1933 during a visit to Scandinavia, and I am much indebted to Dr. L. Størmer for guiding me over the section at Vaekkerø, and to Dr. T. Strand for similar help with the Slemmestad section. Other material was studied during a visit to Canada in 1939, and I wish to thank Dr. I. W. Jones, of the Quebec Bureau of Mines, and Professor T. H. Clark, of McGill, for their kindness in showing me the collections in their care, and for the generous gift and loan of material subsequently. Finally, I record my gratitude to Dr. R. Ruedemann for his friendly discussion and advice during my visit to Albany, N.Y., and to the Council of the Geological Society of London for an award from the J. B. Tyrrell Fund in 1939.

II. THE STRUCTURE OF THE PROXIMAL END IN EARLY DICHOGRAPTIDS.

In *Dictyonema flabelliforme* the proximal end of the rhabdosome originates in a sicula from which diverge three primary branches. The initial bud, I°, gives rise to a bitheca and two budding-individuals, one of which (that on the crossing-canal side) immediately divides again, so that the sicula is surrounded at a very early



Thecal diagrams of the proximal end of the rhabdosome in *Dictyonema flabelliforme* and various Tremadocan dichograpids. Bithecæ are as yet unknown in the genera *Bryograptus* and *Staurograptus*, and are therefore indicated in the diagrams by broken lines; they are shown in continuous outline in *Clonograptus*, *Adelograptus*, and *Anisograptus*, though they are probably not present in all species of these genera and therefore probably lost within the limits of these genera independently.

stage in development by three budding-individuals which originate the three primary branches. In 1927, and again in 1936, I named these I^1 , I^2 , and I^3 , originating the thecae $th\ I^1$, $th\ I^2$, and $th\ I^3$; in the accompanying text-fig. 1 I have re-lettered these thecae $th\ I^1$, $th\ I^2 a$, and $th\ I^2 b$, in order to emphasize what now seems to me perhaps the most distinctive feature of the *D. flabelliforme* development, namely, that what corresponds to $th\ I^2$ in ordinary graptoloidea is here "double" ($th\ I^2 a$, $th\ I^2 b$).

In *Clonograptus tenellus* the mode of development, as worked out by Stubblefield (1929), involves a suppression of the peculiar $I^2 I^3$ division of *D. flabelliforme*, so that there are only two primary stipes; this is accompanied by an accelerated development of $th\ I^1$ and $th\ I^2$, which is of minor importance in the present discussion. If we regard this species as a direct descendant of *D. flabelliforme*, then the most important changes marking its appearance are: loss of dissepiments, change in direction of growth of the rhabdosome, and reduction to two primary stipes.

From a study of Ruedemann's genus *Anisograptus* it now becomes clear that there were also descendants of *D. flabelliforme* or some other dendroid ancestor in which the three primary branches persist. What I have seen of the proximal ends of various well-preserved anisograptids convinces me that this trifid structure is based on $th\ I^1$, $th\ I^2 a$, and $th\ I^2 b$ (see text-fig. 1), and may reasonably be regarded as a direct inheritance from some dendroid ancestor. *Triograptus* Monsen is probably a descendant of *Anisograptus* in which the three primary stipes remain unbranched.

This is likewise the mode of development of the proximal end in *Bryograptus kjerulfi* and several other species of that genus.

But *Bryograptus* more than any other of the multi-ramous dichograptids has become a dumping-ground for little-understood species, and almost any pendent or declined form with rather irregular branching has been assigned to this genus. Among other species so assigned was Moberg's *B. hunnebergensis*. Even before Stubblefield's detailed study of this species Westergård's figures

1 909, pl. v. figs. 19, 20) showed conclusively that there were only two primary stipes, and Stubblefield's work showed that the structure was almost identical with that of *C. tenellus*. It is here proposed to restrict the term *Bryograptus* to those species which agree with the genotype in possessing three primary stipes, and to transfer other species with only two primary branches to the new genus *Adelograptus*. From the early species of *Clonograptus* and *Adelograptus* are probably descended the bulk of the Graptoloidea*.

Stratigraphical evidence suggests that the 2-stiped *Clonograptus* and *Adelograptus* arose from a *Dictyonema* ancestor without the intervention of 3-stiped intermediates, and that there was an early schism into 2- and 3-stiped descendants of *Dictyonema*. But *Clonograptus* and *Adelograptus* may be polyphyletic, and it is theoretically possible that later species could be derived from anisograptid and bryograptid intermediates.

There remains the genus *Staurograptus*. Ruedemann's suggestion that both th l^1 and th l^2 are here "double" and that four primary stipes diverge from the sicula seems entirely convincing, but preservation of all material of this genus is very poor, and the interpretation is derived on theoretical grounds. The structure may prove to be even more complex. The genus is most probably an independent offshoot from some *Dictyonema* ancestor (though it could be derived from *Anisograptus*) and seems lacking in descendants. However, if Monsen's *Tetragraptus kolderupi*, of the *Ceratopyge* Shales, really has four branches radiating direct from the sicula it may be related to *Staurograptus* as *Triograptus* is to *Anisograptus*.

III. SYSTEMATICS.

Bryograptus Lapworth, 1880 (restricted).

Original diagnosis: "Polypary bilaterally subsymmetrical, consisting of two compound monopruionidian branches diverging at a small angle from a well-marked sicula, and originating similar compound (or simple?) secondary branches at close but irregular intervals from one margin only. Hydrothecæ minute, of the type of those of *Dichograptus* Salt." (p. 164).

* It may be noted that *Didymograptus kieri*, of 3aß, is so nearly identical, as regards sicula and hydrothecæ, with *Adelograptus hunnebergensis* that outline drawings of the two practically coincide when superimposed.

Genoelectotype: *Bryograptus kjerulfi* Lapworth (Gurley, 1896).

The genus was stated in the discussion to differ from *Clonograptus* and *Dichograptus* mainly in the fact that second- and third-order branches are given off at irregular intervals, while the chief branches make but a small angle with one another, "composing an irregular polypary of an irregular dendroid form."

Bryograptus kjerulfi is characteristic of a high level in the *Dictyonema* Shales of Scandinavia, from whence it has been figured by Brögger, Moberg and Segerberg, and Westergård. Some at least of the figures given by these authors (Moberg and Segerberg, 1906, pl. i. fig. 14; Westergård, 1909, pl. v. fig. 8) show three primary branches; and where only two are visible (Lapworth, 1880, pl. v. fig. 20, copied from Kjerulf; Brögger, 1882, pl. xii. fig. 20; Westergård, 1909, pl. v. fig. 9) this is probably due to concealment of the third (central) stipe by matrix. Where sediment has filtered into the rhabdosome before consolidation, so that the rhabdosome as a whole is preserved in some relief, only two of the primary stipes will be visible; but where the rhabdosome has been quickly covered by sediment and all the branches are spread out upon the same bedding-plane then three primary stipes will be visible.

It is here proposed to restrict the genus to those forms which agree with the genotype in possessing three primary stipes, and to transfer species with only two primary stipes to the new genus *Adelograptus*.

Bithecæ and budding-individuals have not yet been recorded in any of the species here referred to *Bryograptus*, and the thecal constitution of this genus is very imperfectly understood.

The distinction from *Anisograptus* is arbitrary, declined rhabdosomes being essentially transitional between the two genera.

Revised diagnosis: *Rhabdosome sub-symmetrical, pendent or declined, dendroid, produced by somewhat irregular division (dichotomy or lateral branching) of three primary branches.*

1. *Bryograptus kjerulfi* Lapworth.

Graptolithus tenuis Kjerulf, 1865, p. 3, figs. 6 a, b.

Bryograptus kjerulfi Lapworth, 1880, p. 164, pl. v. fig. 22.

Bryograptus kjerulfi Brögger, 1882, p. 37, pl. xii. figs. 20, 20 a.

?*Bryograptus kjerulfi*

Upper part of *Dictyonema* Shales (*norvegica* zone) of Scandinavia: apparently the same species is recorded from the Lower Ordovician (Skiddaw Slates) of Britain.

2. *Bryograptus kjerulfi* ? var. *cumbrensis* (Elles & Wood).

Bryograptus kjerulfi var. *cumbrensis* Elles & Wood, 1902, p. 89, pl. xii. figs. 4 a, b.

Lower Ordovician (Skiddaw Slates) of Britain, associated with *Tetragraptus bigsbyi* (Elles & Wood, 1902, p. 89).

3. *Bryograptus patens* Matthew.

Bryograptus patens Matthew, 1892, p. 95, pl. vii. figs. 1 a-d.

Bryograptus patens Matthew, 1895, p. 268, pl. xlviii. figs. 4 a, b, c.

Bryograptus lentus Matthew, 1895, p. 270, pl. xlviii. figs. 2 a, b.

St. John Group (Divisions 3 b and 3 c), Navy Island, New Brunswick; ? Schaghticoke Shale, New York.

It is with some hesitation that I differ from Dr. Ruedemann and re-erect this as a valid species. Ruedemann, after examining large quantities of material, concluded that *B. patens*, *B. lentus*, and *Clonograptus proximus* Matthew were all synonyms of *Staurograptus dichotomus* Emmons. While agreeing as regards the third of these, and also that the first two are synonyms, I am nevertheless inclined to regard their pendent habit as more than a mere preservational feature, and to think that there were not more than three primary branches. I would tentatively consider Ruedemann's figures 20, 21 (1904, pl. ii.; *Staurograptus dichotomus* and var. *apertus*) as referable to *B. patens*.

4. ? *Bryograptus spinosus* (Matthew).

Clonograptus spinosus Matthew, 1892, p. 97, pl. vii. figs. 2 a, b.

Bryograptus spinosus Matthew, 1895, p. 269, pl. xlviii. figs. 3 a, b.

St. John Group (Divisions 3 b and 3 c), Navy Island, New Brunswick.

5. ? *Bryograptus ramosus* Brögger.

Bryograptus ramosus Brögger, p. 37, pl. xii. figs. 21, 21 a.

? *Bryograptus ramosus* Monsen, 1925, p. 160, pl. i. fig. 9, text-fig. 3.

Lower part of the *Ceratopyge* Shale, Norway.

If there are but two primary stipes, as stated by the author of the species, it should presumably be referred

to *Adelograptus*, but the figure is an obverse view, and the central (th 1² a) stipe may be concealed. Three primary stipes are shown in Monsen's figures, and the general habit of the species is typically bryograptid.

6. ? *Bryograptus bröggeri* Monsen.

Bryograptus bröggeri Monsen, 1925, p. 162, pl. i. figs. 10, 11, text-fig. 4.

Lower part of the *Ceratopyge* Shale, Norway, associated with *Bryograptus ramosus*.

7. ? *Bryograptus callavei* Lapworth.

Bryograptus Callavei Lapworth, 1880, p. 165, pl. v fig. 21.

The original of this species, one of the genosyntypes, was missing at the time when the 'Monograph of British Graptolites' was being prepared, and has never since been recovered. It was reputed to come from the Shineton Shales of Cound Brook, Shropshire—a locality which "is unlikely to be correct" (Stubblefield, 1929, p. 283)—and no graptolite of this character has been recorded from the Shineton Shales since then. I agree with Stubblefield that it is very improbable that what is now known as *Clonograptus tenellus* var. *callavei* is a synonym of this missing form and that that variety should therefore be renamed. But it is not certain, however, that Moberg's *Bryograptus sarmentosus* is a synonym of *C. tenellus* var. *callavei* and that the variety should accordingly be renamed *C. tenellus* var. *sarmentosus*. Moberg's original figures show a form which may perhaps be an incomplete *Clonograptus* but also might be referable to *Anisograptus*. If this prove correct then what is here described as *A. ruedemanni* (p. 111) is probably very nearly related if not synonymous.

***Anisograptus* Ruedemann, 1937.**

Original diagnosis: "Rhabdosome bilaterally symmetrical, typically possessing 12 or more slender uniserial terminal branches, produced by repeated dichotomous division, but with an asymmetric funiculus" (p. 61).

Genotype: *Anisograptus matanensis* Ruedemann, 1937 (original designation).

The essential character of the genus, as noted by Ruedemann in his discussion, lies in the asymmetric

funicle. In *Anisograptus* "the opposite thecæ produce two buds and two branches on one side and one branch on the other." In Ruedemann's diagram of the proximal end (fig. 3) the "double bud" is shown as $th\ 1^1$, and I adopted this interpretation in 1938 (fig. 28); but I now believe, both from observations on *A. matanensis* and *A. ruedemanni* and from the probable derivation of the genus from *Dictyonema*, that this is incorrect, and that $th\ 1^2$ is the divided theca. Ruedemann states in his discussion of the genus that the undivided branch (that on the $th\ 1^1$ side on my interpretation) bifurcates after the first theca, but this is probably a specific rather than a generic character, and I have included in the genus several species in which the first-order $th\ 1^1$ stipe is three or more thecæ in length.

Bithecæ and budding-individuals are apparently present in the genotype and probably also in *A. richardsoni*; their presence as a generic character is unproved.

The rhabdosome varies from declined to horizontal or evenly slightly reclined, and the genus might be regarded as a *Dictyonema* in which the stipes are not generally developed to very high orders and in which, following the loss of dissepiments, they have assumed a more or less horizontal direction of growth.

Where the sicula is not visible the rhabdosome of some species bears a considerable resemblance to a *Clonograptus* with a very short funicle, and it is possible that some so-called *Clonograptus* species should be referred to this genus.

1. *Anisograptus matanensis* Ruedemann. (Pl. II. fig. 5.)

Anisograptus matanensis Ruedemann, 1937, p. 62, figs. 6-9.

Matanne Shale (? U. Tremadocian), associated with *Trio-graptus osloensis* and *Dictyonema canadense* Lapworth MS.; Matanne, Province of Quebec.

It may be added to the published description that bithecæ are visible on some of Ruedemann's specimens (N.Y. State Mus.) and are of the simple, external type seen in *D. flabelliforme* and *Cl. tenellus*, while a sinuous, hair-like tube formed of the chain of budding-individuals can be seen along the back of the stipes in the partly pyritized specimen represented in Pl. II. fig. 5.

2. *Anisograptus richardsoni*, sp. n.

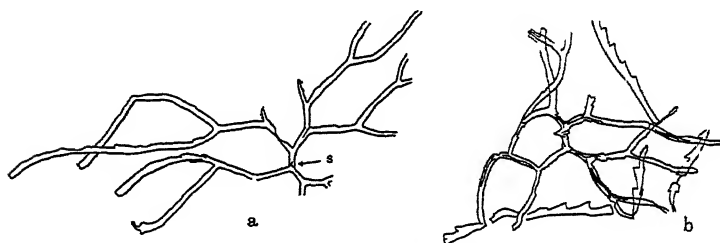
(Pl. II. fig. 6 ; text-fig. 2.)

Matanne Shale (? U. Tremadocian) ; Matanne and Cape Rosier,
Province of Quebec.

Holotype : specimen A10,043 (Sedg. Mus.), text-fig. 2 b.

Rhabdosome minute, horizontal, composed of slender stipes bifurcating frequently at short intervals. First-order stipes (including the funicle) about 1 mm. in length ; second-order 1-2 mm. ; third-order, 2-2.5 mm. ; thereafter at increasing but somewhat irregular intervals. Entire rhabdosome about 4 cm. in diameter, composed of some 40 or more stipes, to fifth- or sixth-order. Branches about 0.25-0.3 mm. wide in dorsal aspect, about 0.4 mm. measured across the thecal apertures in lateral view.

Text-fig. 2.

*Anisograptus richardsoni*, sp. n.

a, specimen A 10,044 (Sedg. Mus.), *b*, specimen A 10,043 (Sedg. Mus.), holotype. Both specimens from Cape Rosier, P.Q., given to the writer by Dr. I. W. Jones. $\times 3.2$ approx. *s*, sicula ; indications of budding-individuals are to be seen in the holotype.

Sicula inconspicuous, often not recognizable, 0.7 mm. long in the holotype.

Thecae not usually visible ; in the holotype (text-fig. 2 *b*) the number seems to be about 11 in 10 mm. They are slender and elongate, not strongly denticulate. Bithecae are not recognizable, but budding-individuals appear to be present (text-fig. 2 *b*) and the presence of bithecae is to be expected.

The species is readily distinguishable from other *Anisograptids* by its small size. At first sight it resembles a minute *Clonograptus*, but is easily recognizable if the sicula, or position of the sicula, is visible. Some specimens

which have been referred to *Clonograptus proximatus* Matthew, from the Bretonian of Navy Island, New Brunswick, may belong to this species, though I agree with Ruedemann that the true *Cl. proximatus* is a synonym of *Staurograptus dichotomus* Emmons. It is possible that Mosen's "*Clonograptus tenellus* var. *Callavei*" (1925. pl. i. figs. 5, 6) is nearly related to *A. richardsoni*.

3. *Anisograptus flexuosus*, sp. n.

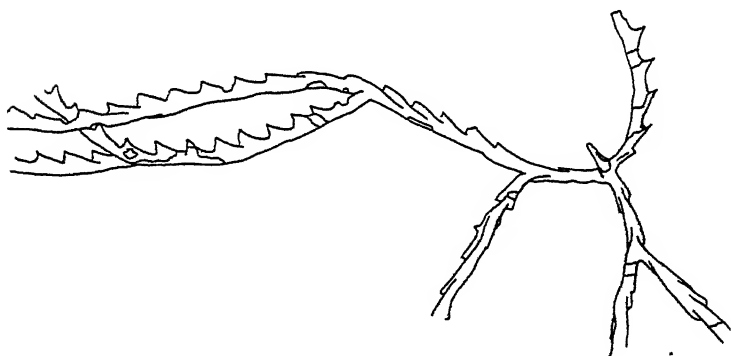
(Pl. II. figs. 1-4; text-fig. 3.)

Matanne Shale (? U. Tremadocian); Matanne, Province of Quebec.

Holotype: Richardson collection, Peter Redpath Museum, McGill, no. 289. (Pl. II. fig. 2; text-fig. 3.)

Rhabdosome almost horizontal, but with somewhat lax, flowing branches and rather irregular branching intervals.

Text-fig. 3.



Anisograptus flexuosus, sp. n.

Proximal end of the holotype, no. 289, Peter Redpath Mus.,
from Matanne. $\times 5$ approx.

First-order branches usually about 2-2.5 mm.; in some instances the funicle may be as short as 1 mm., while other first-order stipes may be 5 mm. or more. Second-order branches 3-5 mm. long; higher orders of greater but variable length. A complete rhabdosome may have a radius of 4 cm. (e. g., the holotype) yet consist of no

more than about 20 branches. The stipes are about 0.5 mm. wide in dorsal view, 0.9–1 mm. in lateral view measured across the thecal apertures.

The sicula is usually conspicuous, slender, more than 1 mm. in length; the three primary stipes diverge from its apertural region.

The thecae number 12 in 10 mm. and are sharply denticulate, with an almost straight ventral margin and smoothly curved apertural margin. Thecal overlap nearly $1\frac{1}{2}$.

The species is closely related to *A. matanensis* Rued., and some specimens (e.g., Pl. II. fig. 3) with a short funicle are chiefly distinguishable only by the greater size of the rhabdosome, the longer intervals between higher order dichotomies, and more distant thecae. From *A. ruedemanni* it differs in its more "spread-out," horizontal, proximal end and more flexuous branches.

4. *Anisograptus ruedemanni*, sp. n. (Text-fig. 4.)

Holotype: specimen A 10,066a (Sedg. Mus.), text-fig. 4d.

Upper part of *Dictyonema* Shales (*norvegica* zone), Vaekkerö, near Oslo, Norway.

Rhabdosome small, declined to horizontal, branches dividing at short intervals (about 2–3 mm.) and diverging strongly after bifurcation. The entire rhabdosome consisted probably of 7–12 stipes, of three (? four) orders. Branches about 0.6 mm. wide in dorsal aspect and 0.9–1 mm. wide measured across the thecal apertures in lateral view.

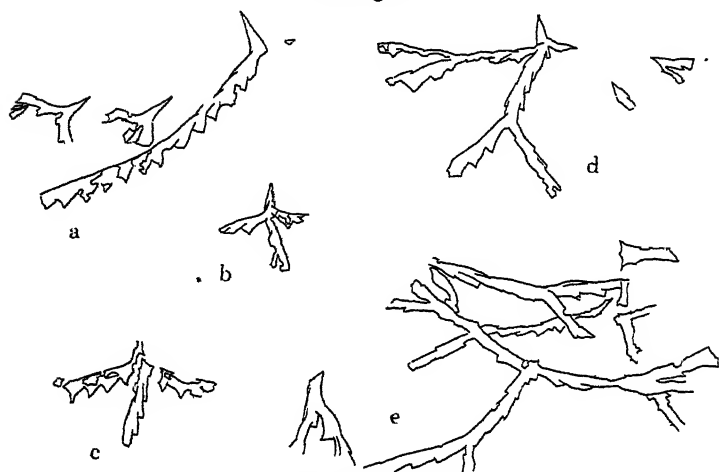
Sicula relatively conspicuous owing to the habit of growth of the rhabdosome, 1.8 mm. in length, slender, conical. The three primary stipes diverge from the apertural region of the sicula, the outer two (th 1^a and th 1² b) enclosing between them an initial angle of 170–180°.

Thecae 12–16 in 10 mm. (material too badly preserved for this number to be constant); in side view the ventral edge has a very slight sigmoidal curvature and the apertural margin is also very slightly sigmoidal, producing an acute denticle. Thecal overlap about $\frac{1}{3}$.

The species differs from *A. matanensis* in the following

features: rather more robust and broader stipes; more declined and less "spread-out" rhabdosome form;

Text-fig. 4.



Anisograptus ruedemanni, sp. n.

a, specimen A 10,057 (Sedg. Mus.), two young rhabdosomes and portion of a rhabdosome showing thecae; *b*, specimen A10,058; *c*, specimen A 10,059 *a*, slightly later growth stages; *d*, specimen A 10,066 *a*, holotype; *e*, specimen A10,067 *a*. All specimens from Vækkerø, in the Sedgwick Museum. $\times 3.2$ approx.

longer funicle (in *A. matanensis* it is composed of one theca only, in *A. ruedemanni* of three or more thecae).

5. *Anisograptus monseni*, sp. n. (Text-fig. 5.)

? *Bryograptus* sp. aff. *Hunnebergensis* Monsen, 1925, p. 166, pl. ii. figs. 1, 17.

? *Bryograptus Hunnebergensis* var. *norvegica* Monsen, 1925, p. 165, pl. i. figs. 13, 14, 15.

? *Dichograptus* ? sp. Monsen, 1925, p. 168, pl. ii. fig. 5.

Ceratopyge Shales, 3 a β ; Stenbergstrasse, Oslo, and Slemmestad.

Holotype: specimen A 10,048 (Sedg. Mus.), text-fig. 5 *b*.

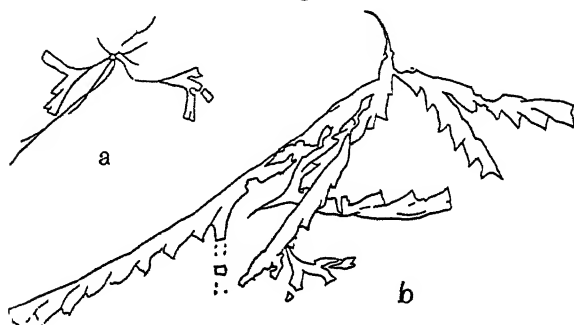
Rhabdosome declined, with short funicle (one, or ? two thecae), dividing dichotomously to third- (? fourth-) order stipes, and probably composed of 8–12 terminal stipes when complete. Branches about 0.5 mm. wide in dorsal view, 0.8 mm. wide measured across the thecal apertures in lateral view.

Sicula conspicuous, 1.8–2 mm. in length, usually with well-developed nema. Of the three primary stipes th 1^1 diverges from near the middle of the sicula, th $1^2 a$ and th $1^2 b$ nearer the aperture: th 1^1 and th $1^2 b$ enclose between them an initial angle of about 120° .

Thecae about 12 in 10 mm.; in side view the ventral wall is distinctly sigmoidal, the apertural margin straight or slightly curved, and the denticle very acute. Thecal overlap $1/3$ to $1/2$.

The species is distinguished from *A. ruedemanni* by its more declined habit and shorter "funicle." In its

Text fig. 5.



Anisograptus monseni, sp. n.

a, specimen A 10,047 (Sedg. Mus.), synrhabdosome composed of numerous broken nemas and two early growth stages apparently belonging to this species. *b*, specimen A 10,048 (Sedg. Mus.), holotype. Both specimens from *Ceratopyge* Shale of Slemmestad. $\times 5$ approx.

pronouncedly declined habit, this species approaches most closely to a true *Bryograptus*.

6. ? *Anisograptus retroflexus* (Brögger).

Bryograptus retroflexus Brögger, 1882, p. 37, pl. xii. fig. 22.

? *Trichograptus* (*Bryograptus*) *retroflexus* Monsen, 1925, p. 166, pl. i. fig. 12.

Upper part of *Dictyonema* Shales (*norvegica* zone), Norway.

Though Brögger states that there are two primary branches it appears from the figure that there may really be three, and this species should be regarded as a reclined *Anisograptus*, possibly nearly allied to *A. flexuosus*. The species has been recorded, with doubt, from the

St. John Group (Division 3 b) by Matthew, 1895, p. 271; this record might be *A. flexuosus*.

7. ? *Anisograptus heres* (Westergård).

Clonograptus (*Staurograptus* ?) *heres* Westergård MS., Moberg & Segerberg, p. 61, pl. i. figs. 12, 13.

Glaucinite Shale (U. Tremadocian, *Shumardia* zone), Northern Öland, Sweden.

The specimens figured are very fragmentary, but suggest comparison with *A. richardsoni*.

Adelograptus, gen. nov.

Diagnosis: *Rhabdosome* pendent to declined or almost horizontal, often somewhat lax and flexuous, formed from two primary stipes by rather infrequent and irregular branching which is apparently usually lateral rather than dichotomous. *Bithecæ* and budding-individuals present in some species, apparently absent in others.

Genotype: *Bryograptus* ? *Hunnebergensis* Moberg.

The genotype represents an almost horizontal, flexuous rhabdosome with comparatively few lateral branches (not, as a rule, further divided) and with a thecal constitution analogous to that of *Dictyonema flabelliforme*, from which it is possibly derived by failure of the I²I³ dichotomy, coupled with an accelerated development of th I². The other species here assigned to the genus agree in most respects with the genotype, though most are more definitely declined or even pendent, and all appear to lack bithecæ. It is possibly a polyphyletic genus, and could theoretically be a descendant of *D. flabelliforme*, *Bryograptus*, or even *Anisograptus*.

1. *Adelograptus hunnebergensis* (Moberg).

Bryograptus ? *Hunnebergensis* Moberg, 1892, p. 92, pl. ii. figs. 5-7 (? 8, 9).

Bryograptus Hunnebergensis Moberg & Segerberg, 1906, p. 61, pl. i. figs. 15, 16.

Bryograptus hunnebergensis Westergård, 1909, p. 64, pl. v. figs. 10-21, 23, ? 22.

Bryograptus hunnebergensis Stubblefield, 1929, p. 273, figs. 2-7.

Dictyonema Shales (Zone of *Cl. tenellus*), Sweden and Britain.

2. *Adelograptus divergens* (Elles and Wood).

Bryograptus divergens Elles and Wood, 1902, p. 90, pl. xii. fig. 2.

? *Bryograptus* cf. *divergens* Benson and Keble, 1935, p. 268.

Lower Ordovician (Skiddaw Slates), Britain; ? Lancefieldian, New Zealand.

3. *Adelograptus lapworthi* (Ruedemann).

Bryograptus lapworthi Ruedemann, 1904, p. 639, pl. v. figs. 1-12.

? *Bryograptus* cf. *lapworthi* Benson and Keble, 1935, p. 270.

Graptolite bed 2, Deepkill, New York; ? Lancefieldian (L 3) and Bendigonian (B 5), Preservation Inlet, New Zealand.

4. *Adelograptus simplex* (Törnquist).

Bryograptus simplex Törnquist, 1904, p. 3, pl. i. figs. 1-4.

Bryograptus simplex Benson and Keble, 1935, p. 270, pl. xxx. figs. 12, 13.

Lower *Phyllograptus* Shales (Zone of *T. phyllograptoides*), Sweden; Lancefieldian (rarely, basal Bendigonian), New Zealand.

5. *Adelograptus pusillus* (Ruedemann).

Bryograptus kjerulfi Ruedemann, 1902, p. 556.

Bryograptus pusillus Ruedemann, 1904, p. 641, pl. iv. figs. 21, 22.

Graptolite bed 2, Deepkill, New York.

6. *Adelograptus victoriæ* (T. S. Hall).

Bryograptus victoriæ T. S. Hall, 1898, p. 165, pl. xvii. figs. 1, 2.

Bryograptus clarkei T. S. Hall, 1898, p. 165, pl. xvii. figs. 3, 4.

Bryograptus victoriæ Harris and Keble, 1932, pl. iv. fig. 2.

Bryograptus victoriæ Benson and Keble, 1935, p. 270.

Lancefieldian (L 2, 3), Victoria, Australia; and Preservation Inlet, New Zealand.

7. *Adelograptus paucillus* Benson and Keble.

Bryograptus paucillus Benson and Keble, in Benson, 1933, p. 403 (nom. nud.).

Bryograptus hunnebergensis Benson and Keble, 1935, p. 269, pl. xxx. figs. 1-11.

Lancefieldian (L 2, 3), Preservation Inlet and Morning Star Mine, New Zealand.

The present writer very much regrets that he was the cause (Benson and Keble, 1935, p. 269) of this species being identified as *A. hunnebergensis*. There must have been some misunderstanding. The species does seem to the writer almost indistinguishable from *A. victoriæ*, which in turn seems to him synonymous with Hall's *Bryograptus clarkei*; if these three forms are not synonymous they are surely not more than varietally distinct.

8. ? *Adelograptus crassus* (Harris and Thomas).

Bryograptus crassus Harris and Thomas, 1938 a, p. 72, pl. i. fig. 7, pl. iv. fig. 6.

Basal Bendigonian (B 5), Victoria, Australia.

9. ? *Adelograptus antiquus* (T. S. Hall).

Leptograptus antiquus T. S. Hall, 1898, p. 166, pl. xvii. figs. 5, 6.
Bryograptus (?) *antiquus* Benson and Keble, 1935, p. 266.

Lancefieldian (L 2, 3), Victoria and New Zealand.

The species seems nearly related to Ruedemann's *A. lapworthi*.

***Clonograptus* Hall and Nicholson, 1873.**

Original diagnosis: "Frond composed of numerous (more than eight) stipes proceeding from a common funicle, on the two sides of which they are symmetrically arranged; the frond dividing dichotomously and the process of division going on after the cellules are developed, till ultimately there may be produced from sixty-four to one hundred and forty-four simple celluliferous stipes. No central disc" (p. 138).

Genolectotype: *Graptolithus rigidus* Hall (Miller, 1889).

Revised diagnosis: *Rhabdosome* horizontal, of very numerous stipes, which may reach eighth- or ninth-order dichotomy, proceeding from two primary stipes which constitute the funicle; each order of stipe is commonly slightly longer than the preceding, rigidly diverging, often becoming flexuous or subparallel distally. *Bithecæ* and budding-individuals present in some species, apparently absent in others.

The genus is well characterized and there has been very little wrong usage. The number of described species is considerable and a revision of them is not here attempted. It has already been remarked (p. 107) that a many-branched *Anisograptus* may bear a strong superficial resemblance to *Clonograptus* (e. g., text-fig. 2 b), but the two genera are probably not closely related.

***Staurograptus* Emmons, 1855.**

Original diagnosis: "Disk free, cruciform, arms four, dichotomous, cells terminal, substance membranaceous, free and furnished with an axis" (p. 108).

Genotype: *Staurograptus dichotomus* Emmons (monotypy).

Revised diagnosis: *Rhabdosome* small, bilaterally symmetrical, horizontal, composed of numerous stipes (up to 40 or more) to sixth-order, originating in four

stipes which diverge independently from the sicula
(*th 1¹ a, th 1¹ b, th 1² a, th 1² b*).

The only known material is poorly preserved, but Ruedemann's interpretation (1937) of the structure of this genus (incorporated in the above diagnosis) seems the only logical one—namely, that both *th 1¹* and *th 1²* are duplicated. If this be so, the genus is clearly distinct from all other *Dichograptids*. Some of the published figures seem to suggest that the proximal end may be even more complicated, and the genus must still be considered as very imperfectly known.

1. *Staurograptus dichotomus* Emmons.

Staurograptus dichotomus Emmons, 1855, p. 109, pl. i. fig. 21.

Clonograptus proximatus Matthew, 1895, p. 265, pl. xlviii. figs. 1 a, c, ? b, d.

Staurograptus dichotomus Ruedemann, 1904, p. 614, pl. ii. figs. 1–17, ? 18, 19 (*non 20*).

Schaghticoke Shale. New York State: St. John Group
(Division 3 c), Navy Island, New Brunswick.

It is probable that more than one species has been included in Matthew's *Cl. proximatus*; while fig. 1 a seems an undoubted synonym of *S. dichotomus*, fig. 1 d is distinct and might be a small anisograptid of the type of *A. richardsoni*.

2. *Staurograptus dichotomus* var. *apertus* Ruedemann.

Staurograptus dichotomus var. *apertus* Ruedemann, 1904, p. 617, pl. ii. figs. 23, 24 (*non 21, 22*).

Schaghticoke Shale, New York.

3. *Staurograptus diffusus* Harris and Keble.

Staurograptus diffusus Harris and Keble, 1928, p. 91, pl. ix. figs. 1–5.

Staurograptus diffusus Harris and Keble, 1932, pl. v. fig. 1.

Basal Lancefieldian—L 4 = "Staurograptus Bed"—associated with *Dictyonema campanulatum* and *D. scitulum*, Victoria, Australia.

IV. STRATIGRAPHICAL CONSIDERATIONS.

In Europe the earliest graptoloid genera are *Adelograptus* and *Clonograptus*, represented by the species *A. hunnebergensis* and *C. tenellus* in the *C. tenellus* Zone of the *Dictyonema* Shales (*sensu lato*). At the base of this zone, sometimes distinguished as Transition Beds, they

occur in association with *Dictyonema flabelliforme*. *Bryograptus* and *Anisograptus* are not yet known below the overlying *D. norvegica* and *B. kjerulfi* Zone (*B. kjerulfi*, *A. ruedemanni*, and *A. retroflexus*), with the possible exceptions of the dubious "*B. callavei*" and "*B. sarmentosus*" (see p. 107). From this we may conclude, firstly, that the genera with two primary stipes (*Clonograptus* and *Adelograptus*) are probably descended direct from a *Dictyonema* of *flabelliforme* type without the intervention of 3-stiped graptoloid intermediates; and, secondly, that it is quite probable that forms with three primary stipes (*Bryograptus* and *Anisograptus*) are descended, not from *D. flabelliforme* but from one of its later varieties or allied species. This apparently involves a polyphyletic origin for the Graptoloidea, unless we draw the dividing line between dendroids and graptoloids so as to include *D. flabelliforme* in the latter; theoretically there is some justification for this, but in practice it would be impossible to frame distinguishing diagnoses for these two major groups except by making the distinction to rest upon the presence or absence of a sicula*.

In North America the position is not so clear, for I am inclined to suspect that much passing under the name *Dictyonema flabelliforme* may really be distinct from that species; we cannot be sure of the same well-defined datum line as in Europe, and we have no indication as yet of those early species of *Clonograptus* and *Adelograptus*, *C. tenellus* and *A. hunnebergensis*. The Matanne Shale of Matanne, P.Q., carries *Anisograptus matanensis*, *A. richardsoni*, and *A. flexuosus*, associated with *Dictyonema canadense* Lapworth MS. and *Triograptus osloensis* Mosen, a species which is, in Norway, of *Ceratopyge* Shale age. *A. richardsoni* is also known from Cape Rosier. On the evidence of *T. osloensis* I would provisionally correlate the Matanne Shale (Lapworth's "Cape Rosier Zone" of 1886 in whole or in part) with the *Ceratopyge* Shale, 3 a β , i. e., Upper Tremadocian.

It is probable that the *Staurograptus* Bed (L4) of Victoria, Australia, is at least of high *Dictyonema* Shale age—about *D. norvegica* Zone. The associated *Dictyonemas*, *D. campanulatum* and *D. scitulum*, are very distinct from

* Even so, such dendroids as *Callograptus salteri* Hall and *Dendrograptus regularis* Kozłowski may also possess a siculate proximal end.

D. flabelliforme, and the bed is succeeded by a horizon, L 3, which in New Zealand carries *Triograptus otagoensis* and which may provisionally be considered of late Tremadoc age. Moreover, the true *C. tenellus* has never, so far as I know, been recorded from Australia or New Zealand. (The existing records of *C. tenellus* and *A. hunnebergensis* are almost certainly incorrect identifications.)

Returning now to Eastern North America, it may be tentatively suggested that the Schaghticoke Shales, with *Staurograptus dichotomus*, might be paralleled with L 4 of Australia rather than with the *D. flabelliforme* beds of Europe. I hope that Dr. Ruedemann and I may have the opportunity of revising together the various so-called *Dictyonema flabelliforme* of Eastern North America. The *Dictyonema* Beds of Matthew's St. John Group, Division 3, are so imperfectly described and understood that I venture no comment, except to remark that the "*Dictyonema flabelliforme*" has not yet been satisfactorily figured or described.

As regards vertical range, *Bryograptus* and *Anisograptus* seem to be confined to the Tremadocian, with the exception of the species recorded as *B. kjerulfi* and var. *cumbrensis* from the Skiddaw Slates (var. *cumbrensis* at least is proved by its associates to be Lower Arenig). *Adelograptus* and *Clonograptus*, on the other hand, range well up into the basal Ordovician, and there are numerous species of *Adelograptus* from the Skiddaw Slates, Lower *Phyllograptus* Shales, Deepkill, Lancefieldian, and Bendigonian, and of *Clonograptus* from Zone A of the Levis Shales, the Lower *Phyllograptus* Shales, Lancefieldian and Bendigonian. There is, however, a rather remarkable gap between the Lower Tremadocian and basal Ordovician occurrences of these two genera. *Bithecae* have never yet been recorded in the higher species, which, so far as can be determined, are all of typical graptoloid structure.

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EXPLANATION OF PLATE II.

Anisograptus flexuosus, sp. n.

- Fig. 1. Specimen 290 (underside); showing three primary branches diverging from the sicula, s.
Fig. 2. Specimen 289—holotype.
Fig. 3. Specimen 290 (upper side): rhabdosome with rather short first-order branches and a habit approximating to that of *A. matanensis*. Position of sicula, s.
Fig. 4. Specimen 291: a tangled mass of rhabdosomes showing hydrothecæ.

Anisograptus matanensis Ruedemann.

- Fig. 5. Specimen 301: proximal end, partially pyritized, showing the fine tubular budding-individuals in relief; the partially filled thecal cavities are difficult to interpret, but bithecæ occur in this species.

Anisograptus richardsoni, sp. n.

- Fig. 6. Specimen 292; showing the *Clonograptus*-like appearance of this species.

All specimens from the Matanne Shale, Matanne, Province of Quebec; from the Richardson Collection, Peter Redpath Museum, McGill University, Montreal.

Figs. 1-4, 6, natural size; fig. 5, $\times 7.5$ approx.

VII.—Two new Generic Names in the Nemopteridæ (Neuroptera). By J. COWLEY, M.A., F.R.E.S.

WHILE studying the generic nomenclature of the Nemopteridæ it became evident that two of the generic names now recognized taxonomically were preoccupied and that a third name had never had a genotype assigned to it; these nomenclatural inconsistencies are remedied in the present paper, and notes are also included on the habitat of a little-known Chilean species. At a later date it is hoped to deal with the generic taxonomy of the family. I wish to thank the editor of the 'Nomenclator Zoologicus,' Dr. S. A. Neave, for drawing my attention to the pre-occupation of *Stenorrhachus* McLachlan.

NEMOPTERYX Leach, 1815, Zool. Misc. ii. p. 73.

It appears that hitherto no type has been designated for this genus; two species, *lusitanica* Leach, 1815, and *africana* Leach, 1815, were originally included in the genus. I hereby select *Nemopteryx lusitanica* Leach, 1815

(=*Nemoptera bipennis* (Illiger, 1812)) as the genotype of *Nemopteryx* Leach, 1815. *Nemopteryx* is consequently confirmed as a synonym of *Nemoptera* Latreille, 1802.

STENONEMIA, nom. nov.

Stenotania McLachlan, 1885, Trans. ent. Soc. Lond. 1885, p. 376. (Genotype (only original species): *Stenotania walkeri* McLachlan, 1885. (Preoccupied by *Stenotania* Gervais, 1871, C. R. Acad. Sci. Paris, lxxi. pp. 780, 781, in Cestoda.)

Stenorrhachus McLachlan, 1886, Proc. ent. Soc. Lond. 1886, p. lviii. (Nom. nov. pro *Stenotania* McLachlan, 1885. Preoccupied by *Stenorrhachus* Koch, 1847, Krit. Rev. Ins. Dtschl. p. 85, in Myriapoda.)

Stenorrhachus Navás, 1910, Mem. Acad. Barcelona (3) viii. p. 366 (error for *Stenorrhachus* McLachlan, 1886).

Generic characters.—Differs from all other Nemopterine genera in the following combination of characters:—Rostrum very short. Fore wings, between R_1 and R_s one cell-row for 11–14 cells, then a double row for 5–8 cells, followed by one cell-row to the wing-margin (3–4 cells); 6 cross-veins between Cu_2 and $1A$; 3 marginal cells between the apices of $2A+3A$ and $1A$ (this last character perhaps not significant). Hind wings narrowly tape-like, not dilated towards the apex.

Genotype: *Stenotania walkeri* McLachlan, 1885 (= *Stenonemia walkeri* (McLachlan, 1885)).

Derivation.—στενός, narrow; nemia, an arbitrary formation from νῆμα, νήματος, thread (with reference to the hind wings), suggested as a convenient ending for the names of Nemopterine genera.

Navás (1910) combined *Stenorrhachus* and *Savigniella* Kirby, 1900, in a single genus; in 1931 he reversed his previous decision and considered them as two separate genera, but without indicating what he considered to be their distinctive characters. *Stenonemia* I consider to be quite distinct from all other Nemopterine genera, so that there is almost no possibility of its being placed in the synonymy of another genus; pending a thorough revision of the genera of Nemopteridæ the diagnosis given above will serve to characterize it. *Savigniella* Kirby, the only other Nemopterine genus with a short rostrum, differs in having in the fore wing only one row of cells between R_1 and R_s to the wing-margin, 2–3 cross-veins between Cu_2 and $1A$, and only two marginal cells between the apices of $2A+3A$ and $1A$.

Stenonemia walkeri (McLachlan, 1885).

Some time ago I was able, through the courtesy of Mr. D. E. Kimmins, to make a brief inspection of the type, the only known specimen of this species, in the British Museum (McLachlan Collection). At the present time the type is no longer available for more detailed study, having been removed to a place of greater safety: I have included in the generic diagnosis a few of the venational peculiarities which I had been able to note.

In his original description McLachlan gives as the habitat "... observed by him [J. J. Walker] not uncommonly on a sandy spit at Coquimbo, North Chile, at the end of January and beginning of February." I have consulted the late Commander J. J. Walker's diaries, now in the Library of the Royal Entomological Society of London, and give the following extracts from his manuscript "Journal and Observations in Natural History made in H.M.S. 'Kingfisher,' 27th Sep^r, 1880 to 31st Decr. 1881." (anchored in harbour of Coquimbo) Jan. 22nd, "I went ashore about 4 o'clock and, turning to the left on landing, about ten minutes walking brought me out on the wide sandy beach at the north end of the town. The beach ... was covered in places with various plants, among which were great beds of a species of *Salicornia*, very like our *S. herbacea*, but larger and more vigorous. A very pretty fine-leaved plant with pink flowers about the size of a three-penny-piece, in all probability a species of *Frankenia*, was plentiful and conspicuous: various *Carexes* (one species growing 6 feet high), *Compositæ*, and other weeds, occupied the extensive flat sandy space at the back of the beach, through which ran the railway to La Sereña." Jan 24th, "A beautifully fine clear day. I went on shore about 4 p.m. for a couple of hour's work along the La Sereña railway-line, but I did not meet with much success ... I got ... a singular Nemoptera, with the hind-wings dilated into slender filaments about 3 inches long, the fore wings expanding about 1 1/2 inches. It was fatiguing, walking in the loose dry sand, and I was glad to get on board at 6.15 p.m." I have read through all that part of Walker's diary which relates to his stay at Coquimbo, and the passage quoted above is the only one in which Nemopteridæ are referred to; I do not know the origin of McLachlan's phrase

"not uncommonly." unless it were from a personal communication from Walker to McLachlan, though even so one would expect so careful an observer to have noted in his diary the occurrence of more than one specimen on one occasion if he had observed them "not uncommonly."

DIELOCROCE, nom. nov.

Nina Navás, 1910, Mem. Acad. Barcelona (3) viii. pp. 352, 405. Genotype (original designation): *Nemoptera* (*Croce*) *baudii* Griffini, 1895. (Preoccupied by *Nina* Horsfield, 1829, Cat. Lepid. Ins. Mus. E. India Co. p. 140, in Lepidoptera; Gray, 1850, in Mollusca; Gray, 1855, in Echinodermata; Grebniecki, 1873, in Protozoa.)
 ?*Croce* Navás, 1912, Genera Insect. cxxxvi. p. 17. Genotype (designated in error): *Nemoptera alba* Olivier, 1811 (= *Dielocroce*? *alba* (Olivier, 1811)). (Nec *Croce* McLachlan, 1885, genotype *Nematoptera filipennis* Westwood, 1841.)

Generic characters.—Rostrum of both sexes about three times the dorsal interocular distance; "axillary" vein in fore wing fused for the greater part of its length with Cu_2+1A , appearing merely as a marginal branch of the latter; ♂ with a bulla in basal third of both fore and hind wings, ♀ without bullæ; fore wings, origin of *Rs* distinct and bowed slightly away from R_1 at first, but later running nearer to it; 2 cross-veins between *R* and *M* before origin of *Rs*; 2-3 cross-veins between *Rs* and *M* before *Rs* forks; unbranched stem of *Rs* about 1/6 the length of the branched portion and often even shorter; origin of M_{3+4} (oblique vein between *M* and Cu_1) nearly opposite origin of *Rs*, or at least not further distad than the level of the first cross-vein between R_1 and *Rs*; hind wings long, simple and filiform (with a bulla in ♂).

Genotype: *Nemoptera* (*Croce*) *baudii* Griffini, 1895 (= *Dielocroce baudii* (Griffini, 1895)).

Derivation.— $\delta\iota$, two; $\eta\lambda\sigma$, stud, boss (bulla); *Croce*.

With regard to the desirability of proposing a new name for *Nina* Navás, it is clear from the work of Withycombe (1923) that it is a taxonomically valid genus and that there is little possibility of its being relegated to the synonymy of any other genus as defined by Withycombe or since described; indeed, it is more likely that in the future the number of genera in the Crocinæ will be increased rather than diminished by the fusion of hitherto recognized genera. It is unfortunate that the genotype should be a little-known species, but it is quite

clear from Griffini's (1895) description and figure of *baudii* that it cannot be placed in any other of the genera at present recognized but this.

There remains the question of the identity of the genus *Necrophylus* Roux, 1833, erected for the species *arenarius* Roux, 1833, and known only from the larva. At present the larvæ of only five (out of over 80) species are known (in addition to *N. arenarius*), and the identity of one of these is still unconfirmed; Wheeler (1929) has given the fullest and most recent discussion of the case of *N. arenarius*. Roux's figure cannot be identified with any certainty, and his specimen (or specimens) appears to be non-existent; Wheeler therefore considers Roux's name to have been validated taxonomically by Schaum (1857), who described larvæ which he considered to be conspecific with those of Roux; two of Schaum's larvæ studied by Wheeler were apparently identical with *Pterocroce storeyi* Withycombe, 1923. and consequently Wheeler considered that *Necrophylus* Roux, 1833, should replace *Pterocroce* Withycombe, 1923. But in my opinion the Crocine species of Nemopteridæ are so little known that there still remains the possibility that on the discovery of further species and larvæ it may be found that, even if Roux's larva remains unidentified, Schaum's larva is that of some other species than *P. storeyi* (although perhaps it is less likely to be the larva of a species of *Diolocroce*). I would therefore suggest that the replacement of *Pterocroce* by *Necrophylus*, and of *P. storeyi* by *N. arenarius*, be deferred until we have far more knowledge of the larval forms. There is also the nomenclatural status of *Necrophylus* to be considered: in Roux's text this appeared as *Necrophylus*, but on the plate (perhaps as an editorial emendation) as *Necrophilus*, and the latter form is preoccupied by *Necrophilus* Latreille, 1829, in Cuvier, R. Anim. ed. 2, iv. p. 500, in Coleoptera; it may be questioned whether *Necrophylus* Roux, 1833, also is not preoccupied by *Necrophilus* Latreille, 1829, for if they were *specific* names in the same genus they would be homonymous under the International Rules, Art. 35*a*. The homonymy of specific names differing only in certain details of spelling are dealt with under five heads in Art. 35, but for generic names we are given no help at all, merely being told to reject homonyms.

The International Commission should, I think, be requested to elucidate Art. 34 (homonymy of generic names), and in particular to decide to what extent the principles governing the homonymy of specific names, as detailed in Art. 35 *a-e*. are applicable to generic names. I have before me a list of several generic names in Odonata as to the validity of which I am for this reason in doubt, which leads me to suppose that there must be a considerable number of such doubtful names in other groups. The Commission could, of course, be asked to deal with each genus or group of genera, by giving a separate Opinion for each, but it would surely be far more logical if, instead of a series of Opinions on selected genera the Commission could be asked for an Opinion dealing with most of the cases likely to arise; I do not see that the Commission could refuse such a defining Opinion by arguing that such cases of possible generic homonymy should each be considered on its individual merits, when definitions of whole blocks of cases of specific homonymy are already embodied in the Rules themselves. Attention in this connection should specially be directed to the endings of generic names, for example: *-a*, *-ea*, *-ia*, *-ya*: *-æa*, *-aia*, *-aja*, *-ea*: *-is*, *-ios*, *-ius*, *-os*, *-us*, *-ys*.

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BIBLIOGRAPHICAL NOTICES.

A General Zoology of the Invertebrates. By G. S. CARTER.
London: Sidgwick & Jackson, Ltd., 1940. xxviii—509 pp.,
172 figs. Price 25s. net.

THE student endeavouring to acquire a knowledge of the wide range of subjects included under the term Zoology, and more particularly that branch of it which deals with the Invertebrata, is liable to find a certain discontinuity in the body of facts presented to him by current text-books. On the one hand there is the bewildering diversity of structure presented under the headings of morphology and systematics, and on the other the modern developments, obviously of profound significance, of comparative physiology and experimental morphology. As a rule these branches of the subject are presented with very little reference from one to the other, and the exponents of the newer branches of knowledge are apt to be a little neglectful (to say the least) of the body of knowledge handed down by their predecessors. Dr. Carter's volume is designed to fill this gap, and, as far as the reviewer is aware, it is the first book, in English at any rate, to make the attempt. The author assumes some knowledge of invertebrate morphology and classification on the part of his readers, referring them to the well-known text-book on the Invertebrata by Dr. Borradaile and others, to which this will form an admirable and indispensable complement.

More than a quarter of the book is devoted to a section dealing with the properties of protoplasm and the free-living cell—that is to say, the Protista—and one-third to comparative physiology. The other sections deal respectively with the growth and form of the multicellular body and with some general problems of invertebrate zoology. The author has evidently given considerable thought to the problem of weaving all these diverse threads into a coherent pattern, and where he has had to leave loose ends he says so. In a work of this scope, even after the whole subject of genetics has been passed by as already well provided for in text-books, many topics have of necessity been omitted which individual readers would have liked to see dealt with. There is, for example, no discussion of the phenomenon of ecdysis, characteristic of Arthropoda and Nematoda. On the other hand, the reviewer has not met anywhere with so full a discussion of the interesting suggestion that the principal invertebrate phyla (but perhaps not all) can be grouped under two "superphyla" typified by the Annelids and Echinoderms respectively.

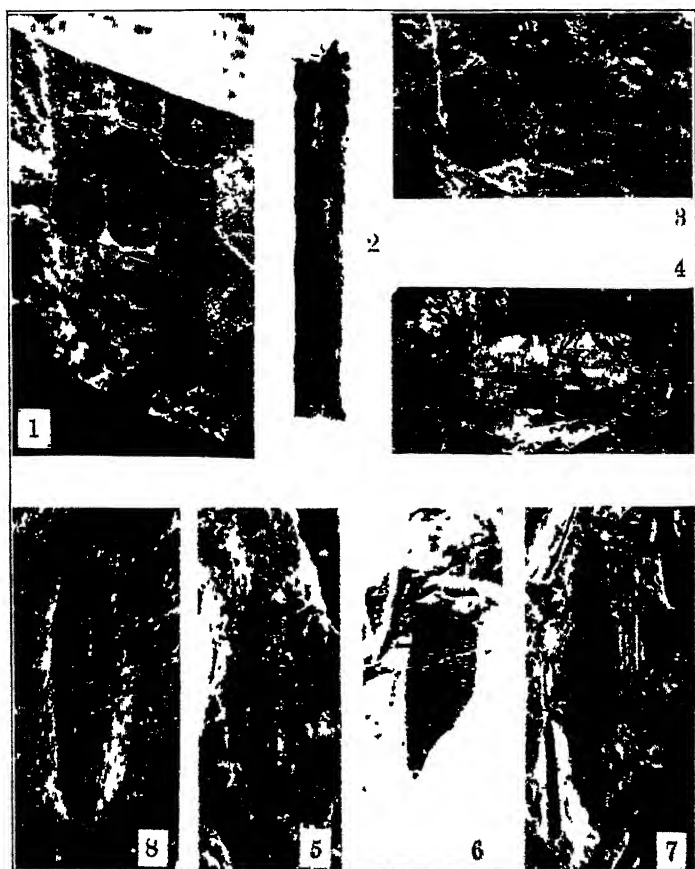
The book can be recommended, without reserve, to the attention of all advanced and honours students of zoology.

The illustrations are, for the most part, excellent, but a few, notably that on page 209, have suffered in the printing.

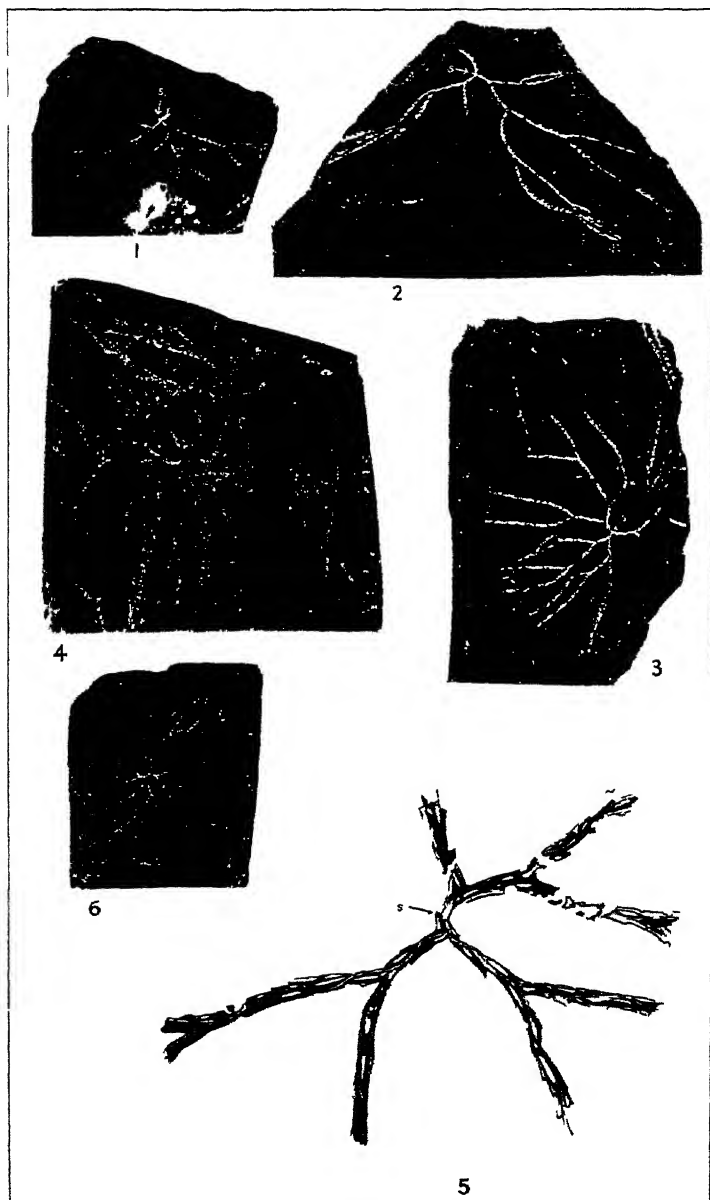
Insect Pests in Stored Products. By H. HAYHURST. Photographs by H. BRITTEN. with a foreword by Sir HAROLD HARTLEY, and a preface by T. W. JONES. London: Chapman & Hall, Ltd. 83 pp., 131 figs. Price 15s. net.

As stated, both in the foreword and in the preface, the present book was intended to fill a most important gap in the literature on economic entomology, since, according to the writers, the literature on insect pests of stored products is "scanty and scattered," while "even more serious has been the complete lack of a practically useful description of the harmful pests." Both statements are grossly incorrect, since the literature on the subject is abundant and includes several books certainly of much greater value than the present one. The book fails entirely in its main purpose of providing "practically useful description" of the insects in question, since the descriptions offered are extremely meagre and in many cases positively misleading. To give an example: on p. 20 five species of *Cryptophagus* are described in exactly the same words, "brown in colour and about 2-2½ mm. long"; their figures show five identical small beetles. Most of the photographs are valueless for identification purposes, while many give an entirely wrong impression. Thus, species of *Necrobius* (plate 23) appear to have white stripes on the thorax and elytra, but these are merely highlights on the very smooth surface. Plate 25 shows some shapeless objects and is intended to assist in recognizing larvæ and pupæ of *Anobium striatum*.

Apart from inadequate descriptions, accompanied by poor photographs, and notes on the kinds of products damaged, the book contains a very sketchy chapter on control methods. This will be of little practical use, since definite recommendations are few and are replaced by vague statements, such as: "A development of recent date, particularly against moths and their larvæ, is the use of sprays, where substances dissolved in oil are atomized"; or, again, "The use of certain mineral substances in the form of a dust has been suggested for the protection of grain." The book ends with "a list of substances and their pests," obviously compiled from limited personal experience of the author (a railway chemist), and therefore very incomplete. The price of the book is very high for its size, probably because of the cost of plates, the number of which is unnecessarily high on account of a most uneconomical distribution of 130 photographs over 48 plates. It is strange that such an unsatisfactory book should be produced in London, where there is no lack of facilities nor of experts in all branches of economic entomology.



Eocene Insects of the Ardtun Beds, Isle of Mull, Scotland.



THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 38. FEBRUARY 1941.

VIII.—*Descriptions of new Species of Ants from New Guinea.* By HORACE DONISTHORPE, F.Z.S., F.R.E.S., &c., Department of Entomology. British Museum (Natural History).

THE following descriptions are based entirely upon the extensive collections brought back by Miss L. E. Cheesman from New Guinea. The material comes from both mountain and lowland country, and is derived from several expeditions. Considerable further material still remains to be examined, and this paper must therefore be regarded as preliminary in nature.

Subfamily *DORYLINÆ* Leach.

Tribe ECITINI Forel.

Enictus papuanus, sp. n.

♂. Brownish yellow, thorax brown, shining, clothed with fine yellow hairs.

Head unicolorous, smooth and shining, as long as broad, truncate posteriorly, rounded at sides, broadest before middle; *mandibles* narrow, armed with minute teeth at base, apical tooth long, curved, pointed, a shorter tooth preceding sharp and pointed; *antennæ*: *scape* only reaching a little beyond middle of head, *funiculus* with last three joints pubescent, joints 5-7 transverse,

Ann. & Mag. N. Hist. Ser. 11. Vol. vii. 9

last joint equal to the three preceding taken together. *Thorax* narrowed to base: *pronotum* rugose anteriorly, anterior angles rounded but distinct, smooth and shining posteriorly; *mesonotum* and *epinotum* rugosely punctured, the puncturation taking the form of small round, raised, shining spots, sides of the same rugosely longitudinally striate; *epinotum* with posterior angles pointed, declivity abrupt, concave. *Petiole* and *postpetiole* with similar puncturation to that of *mesonotum* and *epinotum*: *petiole* armed with a blunt tooth beneath anteriorly projecting forward; *postpetiole* with a smaller sharp pointed tooth; *gaster* long, oval, smooth and shining. *Legs* long, *femora* strongly incrassate: *tibiæ* considerably less so.

Long. 2.6 mm.

Type in B.M. Coll.

Described from a number of workers taken by Miss L. E. Cheesman, Papua, Mafulu, Wharton Range, 4000 ft., xii. 1933, no. 556. The ants' nest occurred in the crevice of a stone.

The worker of only one species of *Ænictus*, *Æ. currax* Emery, has been described from New Guinea. *Æ. papuanus* differs from it in the length of the joints of the antennæ, sculpture, colour of head, etc., and is also much smaller. It may possibly be the worker of one of the two species, the males of which have been described from New Guinea.

Subfamily Ponerinæ Lepeletier.

Tribe Ponerini Forel.

Ponera sabronæ, sp. n.

♂. Reddish brown, antennæ, mandibles, and legs lighter. tarsi and apex of *gaster* pale yellow, somewhat shining, finely punctured and clothed with sparse pubescence and short outstanding hairs, which are more abundant on the *gaster*.

Head without mandibles about as broad as long, rounded at sides, broadest a little before the middle, slightly excised posteriorly; *mandibles* long, curved, crossed at apex when closed, masticatory border armed with seven or eight teeth, the three apical ones being the longest and sharpest; *clypeus* narrow, slightly advanced in centre, anteriorly raised, but not carinate

posteriorly; *eyes* not close to articulations of the mandibles, consisting of about 10–13 facets; *frontal furrow* distinct but not extending beyond two-thirds of the head; *antennæ*: *scape* reaching slightly beyond posterior border of head, *funiculus* gradually thickened to apex, all joints except first and last transverse, *club* not thick nor very distinct, consisting of five joints. *Thorax* narrowed to base; *pronotum* large, convex, transverse, rounded in front and at sides, *pro-mesonotal suture* very distinct; *mesonotum* round, convex, small, much narrower than pronotum, very distinctly defined; the *episternum* of *mesothorax* is separated from the sternum by a faint but distinct suture; *epinotum* not sharply narrow along dorsal surface, *declivity* not abrupt, longer than dorsum, and with sides margined. *Scale of petiole* high, not thick, narrowed to apex, bluntly rounded above, posterior surface slightly concave, anterior surface straight; *gaster* fairly long and pointed. *Sting* strong. *Legs* fairly long.

Long. 3.7 mm.

The worker is somewhat like that of *mocaryi* Emery, but is larger, far less pubescent. there are more facets to the eyes, and the episternum of mesothorax is much more distinct.

♂. Typical *Ponera* male. Brownish yellow, first joint of funiculus of antennæ, mandibles, and margins of segments of gaster white.

Head round; *mandibles* somewhat rudimentary; *clypeus* convex, rounded anteriorly, sharply carinate, *eyes* large, oval; *frontal furrow* deep, reaching median ocellus; *ocelli* small; *antennæ* long; *scape* short; all joints of *funiculus* except the first longer than broad. *Cerci* very small but distinct. *Genitalia* moderate. *Legs* long and slender. *Wings* covered with very short dark hairs which give them a dusky appearance; *pterostigma* and *veins* brown.

Lony. 2.6 mm.

Described from four workers and one male taken by Miss L. E. Cheesman in a nest in rotten wood, Dutch New Guinea, Cyclops Mts., Sabron, 2000 ft., vi. 1936.

Euponera (Mesoponera) robiginosa, sp. n.

Rusty red, extremely finely punctured, giving the insect a velvety appearance, clothed with delicate

pubescence forming a silvery sheen from different aspects : eyes, teeth of mandibles, and anterior and posterior borders of clypeus very narrowly black.

Head without mandibles a little longer than broad, sides and posterior angles rounded, posterior border very slightly emarginate and narrowly margined ; *mandibles* long, narrow, curved, crossed at apex when closed, with a row of seven punctures along masticatory border, which is furnished with twelve somewhat irregular teeth, the apical one being long, curved, and pointed ; *clypeus* narrow, advanced in centre of anterior border, narrowly margined and terminating in a small point, sinuate on each side, upper surface convex, ending posteriorly in a blunt point between frontal carinæ ; *frontal furrow* short, deep anteriorly, shallow and narrow posteriorly : *eyes* large, rather flat, situated in front at sides of head : *antennæ* long, *scape* extending beyond posterior border of head by about one-tenth of its length ; *funiculus* gradually thickened to apex, all the joints longer than broad, second joint longer than third, still longer than first, last joint pointed. *Thorax* long, narrowed posteriorly, *pronotum* robust, convex, with round anterior border and shoulders ; *pro-mesonotal* suture semicircular ; *mesonotum* round, convex, considerably narrower than pronotum, *meso-epinotal* furrow deep, *suture* with very short longitudinal striæ ; *epinotum* with dorsal surface slightly shorter than pro- and mesonotum taken together, *declivity* slanting, flattened, a little shorter than dorsal surface. *Scale* of *petiole* robust, high, thick, rounded above, anterior surface almost straight, posterior surface slightly concave, armed beneath with a blunt tooth-like ridge ; *gaster* long, ovate, anterior surface straight, rounded above ; *postpetiole* broader than, and about the same length as, second segment. *Sting* long, strong. *Legs* long.

Long. 9 mm.

Type in B.M. Coll.

Described from a single worker taken by Miss L. E. Cheesman in Dutch New Guinea, Cyclops Mts., Sabron, 2000 ft., vi. 1936, no. 221, in dead leaves.

This beautiful and distinct ant is the first species of *Mesoponera* to be described from New Guinea.

Euponera (*Mesoponera*) *pulchella*, sp. n.

♂. Dark black-brown. middle of scapes, femora, and tibiae light brown, mandibles, lobes of frontal carinae, funiculi, rest of legs and antennae, apex, part of underside, and sutures of segments of gaster yellow, eyes and apex of teeth of mandibles black. very finely and closely punctured, shining, clothed with a few scattered outstanding yellow hairs. chiefly on clypeus, on underside of mandibles, and at apex of gaster. and with excessively minute decumbent hairs giving a beautiful bluish sheen or reflection to the surface.

Head longer than broad, sides almost straight. shallowly emarginate posteriorly; *clypeus* shape as in *robiginosa* but more or less distinctly carinate; *mandibles* finely punctured, slightly longer, with teeth more developed; *frontal furrow* narrow, extending beyond the half of head; *eyes* small, round. *Thorax* somewhat narrower; *pronotum* not so robust nor rounded, with a faint central carina; *epinotum* with dorsal surface not as long as pronotum and mesonotum taken together, *declivity* concave, with well-marked sides. *Scale* not so high, narrower, and more pointed at apex, projection beneath petiole, less tooth-like, not so deep, and with a straight surface beneath; *gaster* more elongate, armed anteriorly with a short, blunt, projecting tooth. *Sting* long.

Long. 9.5 mm.

Type in B.M. Coll.

♀. Very like ♂ in colour, structure except usual differences, etc.; puncturation slightly stronger, especially of thorax, insect less shining, and the beautiful bluish sheen less evident.

Head longer; *mandibles* longer and stronger, with teeth more developed; *eyes* larger; *frontal furrow* reaching median ocellus. *Wings* light brown, somewhat iridescent; *pterostigma* and *veins* dark brown, one *discoidal cell*, two long *cubital cells* closed, and *radial cell* closed.

Long. 10 mm.

♀ type in B.M. Coll.

Described from two workers and two winged females taken by Miss L. E. Cheesman, Dutch New Guinea,

Cyclops Mts., Mt. Lina. 3500 ft., iii. 1936. In nest in rotten wood.

Tribe PLATYTHYREINI Emery.

Platythyrea quadridenta, sp. n.

♂. Black. extreme apex and base of scapes. funiculi. articulations of the legs, spurs, tarsi, apex of gaster. sting, and masticatory border of mandibles reddish. Dull, clothed with the usual pruinose pubescence, which is distinctly yellowish in colour, and some small scattered shallow punctures and tuft of soft yellow hairs on pygidium.

Head oblong, longer than broad, sides rounded, broadest across eyes, posterior border slightly excised and narrowly margined; *mandibles* with masticatory border armed with 6 or 7 teeth, the apical one the longest, curved and pointed; *clypeus* rounded anteriorly, *frontal carinæ* with a shallow pit or fovea in centre; *frontal furrow* short, shallow, not very distinct; *eyes* large, slightly longer than broad. *antennæ* long; *scape* extending for about a third of its length beyond posterior border of head, *funiculi* with all the joints longer than broad, the second joint being the longest. *Thorax* long, broadest anteriorly, *pronotum* transverse, convex, sides and anterior border and angles rounded, *pro-mesonotal* suture fine but very distinct; *mesonotum* long, narrow, flat above, continuous with dorsal surface of epinotum, separated from the same by a very faint faint round impression, *epinotum* armed with two distinct but blunt teeth at posterior angles of dorsal surface. *declivity* abrupt, concave; *node* of *petiole* longer than broad. narrower at apex, convex above, armed with two blunt teeth at apex which are longer than those of epinotum. space between the teeth semicircular. *declivity* of node concave, *gaster* rounded anteriorly, narrowed to apex, second segment longer than first. *Sting* strong. *Legs* long.

Long. 7.3 mm.

Type in B.M. Coll.

Described from a single worker taken by Miss L. E. Cheesman, Papua, Kokoda, Wharton Range. 1200 ft., v. 1933.

This is a very distinct species, quite different to *P. melancholica* Smith from Morty Island and New Guinea, the structure of the epinotum and node of petiole being something after the style of the large African *P. cribrinodis* Westw., though much more pronounced.

Subfamily MYRMICINÆ.

Tribe PHEIDOLOGETINI Emery.

Oligomyrmex (Oligomyrmex) manni, sp. n.

♀. Brownish red, legs and antennæ yellow, teeth to mandibles black, apex of segments of gaster faintly and narrowly yellow; shining, clothed with sparse, moderately long outstanding yellow hairs, more abundant on gaster, and sparse yellow pubescence.

Head longer than broad, subparallel, posterior border excavate, longitudinally striate anteriorly, more strongly on cheeks and front: *mandibles* robust, armed with 5 teeth, faintly and sparsely punctate and longitudinally striate at base: *clypeus* rounded anteriorly, smooth and concave between frontal carinæ; *frontal* area small, smooth, and shining: *eyes* large, prominent; *ocelli* moderate; *antennæ* 9-jointed. *scape* short, only reaching median ocellus. *Thorax* narrow, longer than broad, sides rounded, narrowed to base, broadest before insertion of wings, very faintly and sparingly punctured: *epinotum* with two short, blunt, triangular teeth, space between somewhat concave. *Petiole* with pedicel slightly rugosely punctured, *node* narrow and slightly emarginate above, armed with a short pointed tooth anteriorly beneath; *postpetiole* broader than petiole, transverse, faintly rugosely punctured: *gaster* long, oval, considerably longer than broad. *Wings* iridescent, one discoidal, one cubital, and long closed radial cell, which is slightly appendiculate at apex.

Long. 5 mm.

Described from four winged females taken by Miss L. E. Cheesman. Papua. Mafulu. Wharton Range, 4000 ft., Jan. 1934.

Type in B.M. Coll.

Considerably larger than *atomus* Emery from New Guinea and the Solomons and *viehmeieri* Mann from the Solomons. Too large for the ♂ of *subreptor* Emery from

New Guinea. It comes nearest to *concinus* Mayr from the Dutch East Indies, but is a little larger and differs in puncturation and structure.

Tribe MERANOPLINI Emery.

Meranoplus rugifrons Emery.

♂. Differs from the ♀ in being larger, darker in colour, and with the sculpture somewhat stronger throughout. The hairiness is similar.

Antennæ slightly thicker in comparison. *Thorax* robust, besides the usual differences quite unlike that of the ♀. *Prothorax* armed with a strong sharp spine at anterior angles; *mesonotum* very convex, rounded; *scutellum* round, prominent; *epinotum* armed with two slightly curved spines which are longer but blunter than those of the ♀. *Petiole* and *postpetiole* thicker and broader.

Long. 4.5 mm.

Described from a dealated female taken by Miss L. E. Cheesman in moss in company with a large number of workers, Papua, Mafulu. Wharton Range, 4000 ft., xii. 33.

♀ type in B.M. Coll.

Emery describes and figures the worker, from Moroka, as a subspecies of *Meranoplus spinosus* Smith, but as the latter is not a *Meranoplus* but a *Procryptocerus* [see Donisthorpe, Ann. & Mag. Nat. Hist. (ser. 10) x. p. 456 (1932)] *M. rugifrons* becomes a good species. In the 'Genera Insectorum' Emery gives p. 152 for Smith's *spinosus*, when it should be p. 150.

Meranoplus sabronensis, sp. n.

♂. Darker or lighter reddish brown, mandibles, antennæ, legs, anterior angles of frontal carinæ, teeth of thorax, and side-rims of gaster yellow, teeth of mandibles and eyes black. Clothed with longer and shorter outstanding yellow hairs. *Head* transverse, broadest before base, posterior angles rounded, posterior border straight when seen from above, longitudinally striate, anteriorly the striæ being broken up just after frontal area into a network of punctures with raised borders; *mandibles* armed with four teeth, the apical one long and sharp, somewhat shining, widely longitudinally striate; *clypeus* with anterior border slightly sinuate, anterior angles pointed, sides with sharp edges, two longitudinal carinæ posteriorly.

slightly concave between, posterior border rounded: *frontal area* indistinct, shining, triangular; *frontal carinæ* widely separated, anterior angles pointed; *scrobes* extending beyond eye by half the eye's length; *eyes* prominent, longer than broad; *antennæ*: *scape* short spindle-shaped, not reaching posterior border of eye; *funiculus* with very distinct 3-jointed club, last joint longer than the two preceding taken together. *Thorax* slightly transverse convex, puncturation as on disc of head, sides with widely separated transverse ridges; *pro-mesonotum* sinuate on each side anteriorly from neck to anterior angles, which are rather sharply pointed, slightly sinuate at sides from anterior angles to middle, where it is broadly excised, followed by a broad blunt tooth, and another sharper one at posterior angles, posterior border almost straight, with two small pointed teeth in middle; *epinotum* concave, smooth and shining, sides strongly margined, armed with a slightly curved sharply pointed tooth before middle, and a very small blunt tooth projecting forward on each side at base. *Petiole* wedge-shaped when seen from the side, narrow above, rounded below, sides striate, anterior surface straight, square, smooth and shining, borders margined, posterior surface slanting, longitudinally striate; *postpetiole* transverse, sculpture as in head and thorax, rounded and convex above, posterior border rounded, anterior border straight, a little higher than petiole, armed beneath with a small blunt tooth projecting forward; *gaster* convex, heart-shaped above, very finely asperately punctured.

Long. 2.3 mm.

Described from six workers taken by Miss L. E. Cheesman on dry soil of a clearing, Dutch New Guinea, Cyclops Mts., Sabron, 1200 ft., vi. 1936.

Type in B.M. Collection.

This species comes nearest to *M. hilli* and *M. auricolus* (Crawley, very small species from Australia, but is abundantly distinct in structure, sculpture, etc.

Subfamily *FORMICINÆ* Lepeletier.

Tribe *CAMPONOTINI* Forel.

Camponotus (Myrmamblys) flavocassis, sp. n.

♂. Black to blackish brown, shining, mandibles reddish, teeth black, cheeks, clypeus, area between the frontal

carinæ, antennæ, tarsi, outstanding hairs light to darker yellow. palpi. apex of coxæ broadly, trochanters, knees. apex of tibiæ. spines at apex of tibiæ, front and side margins of pronotum narrowly, and base of segments of gaster narrowly white to yellowish white; legs and base of scapes brown. Whole body very finely reticulated: the reticulation takes the form of a fine network on head, fine longitudinal striæ on thorax, and still finer striæ on scale and gaster.

Head subquadrate, slightly narrower anteriorly than posteriorly, posterior border slightly emarginate, posterior angles rounded: *mandibles* rather thickly punctured and finely striate. armed with 5 teeth; *clypeus* triangular, transverse, convex. anterior border notched in centre and emarginate before anterior angles, with a few scattered punctures, and broadly carinate in middle: *frontal area* not very distinctly defined; *frontal furrow* fine but distinct; *antennæ*: *scapes* narrow, curved, broadest at apex, reaching a little beyond posterior angles of head. *Thorax* short, convex, robust; *prothorax* transverse, rounded anteriorly, humeral angles distinct, dorsal surface abruptly separated from sides, giving the appearance of a margin; *meso-epinotal suture* deep; *epinotum* rounded above, convex, anterior border margined, *declivity* longer than dorsal surface, abrupt, concave; *petiole*: *scale* thin, rounded and narrowest above; *gaster* straight at base, sides rounded anteriorly and posteriorly. *Femora* and *tibiæ* somewhat compressed, *transversely* striate and punctured.

Long. 6.5 mm.

♂. Colour, structure, sculpture, etc. as in ♀, but *head* more narrowed and with only a narrow border of yellow anteriorly; *mandibles* yellow, teeth black; *antennæ* and legs longer.

Long. 3.4-4 mm.

Described from four soldiers and three workers taken by Miss L. E. Cheesman in Dutch New Guinea, Cyclops Mts., Mt. Lina, 3500 ft.

Type ♀ and ♂ in B.M. Coll.

This is the first species of the subgenus *Myrmamblys* to be described from New Guinea. Other species have been recorded from the Philippines, Queensland, etc. It is quite distinct from any of the known species.

Camponotus (Myrmophyma) cyrtomyrmodes, sp. n.

♂. Black, shining, mandibles, last four joints of tarsi, spurs, and strigils reddish, trochanters brown with lighter base, articulation of antennæ reddish yellow, apex of segments of gaster narrowly, spines at apex of femora, tibiæ, and metatarsi light yellow, very finely reticulated, clothed with short not close decumbant yellow hairs, and sparse scattered, long, outstanding light yellow hairs or bristles.

Head longer than broad, very broad at base, vertex massive and convex, posterior border excised, posterior angles rounded, cheeks straight at sides, concave beneath, the sides of dorsal surface of head between the eye and the posterior angle separated from the ventral surface by an abrupt angle, giving the appearance of a margin; *mandibles* strong, armed with four sharp teeth; *clypeus* triangular, transverse, large, convex; *frontal area* indistinct; *frontal furrow* fine and narrow, only extending as far as the base of frontal carinæ; *clypeal fovea* very marked. *Thorax* convex, narrowed anteriorly and posteriorly, broadest at pro-mesonotal suture, dorsal surface continuous, a slight angle between dorsum and declivity of epinotum; *pronotum* pointed and margined anteriorly, anterior angles rounded, with very abrupt sides; *pro-mesonotal suture* distinct; *meso-epinotal suture* not defined. *Petiole* short, *scale* not high, round above and at sides; *gaster* moderate.

Long. 6 mm.

Superficially very like a worker of a *Polyrhachis (Cyrtomyrma)* species.

♂. Black, shining, finely reticulated, insertion of the antennæ and articulations of the legs narrowly yellow, wings yellowish, pterostigma and veins brownish yellow.

The *head* is more like that of a *Cyrtomyrma*, and the *genitalia* that of a *Myrmophyma*. The *scale* not large nor high, and has the *stigmata* situated on prominences which have the appearance of projecting teeth, sinuate behind these, and then rounded to base, the anterior surface flat, dorsal surface convex.

Long. 5-8 mm.

I can only conclude that this is the male of the above species, though taken on a different date. The reticulation is the same and the decumbent hairs, though more

parse. Described from two workers and a male taken by Miss L. E. Cheesman, Papua, Mafulu, Wharton Range, 4000 ft., ♀, xii. 1933; ♂, i. 1934.

Type and male type in B.M. Coll.

Emery states that there are no constant characters to separate the males of *Polyrhachis* from those of *Camponotus*; so that the fact that this male is very like a *Cyrtomyrma* ♂ is not extraordinary. Miss Cheesman took a number of specimens of *Cyrtomyrma* at Mafulu.

Polyrhachis (Myrmhopla) arcuspinosa, sp. n.

♀. Black, mandibles, antennæ, palpi, legs, apex of pronotum, epinotum, and base of epinotal spines, and sometimes petiole and pronotal spines, yellow-red, teeth

Fig. 1.



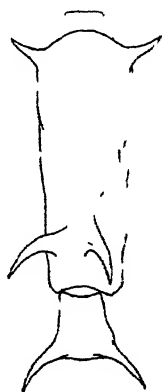
Thorax and petiole of *Polyrhachis (Myrmhopla) arcuspinosa*, sp. n.

of mandibles edged with black, clothed with grey decumbent hairs, which form a pattern on the gaster, as do those of *aureovestitus* Donis. (only the hairs are finer), and long outstanding yellowish-white hairs all over the body and appendages; rugose sculpture of head and thorax of a similar character, but coarser than in *sexspinosa* Latr.

Head longer and narrower than in *sexspinosa*, the space between the eyes and the posterior border also longer, the posterior angles somewhat more projecting; *mandibles* shining, with larger and smaller fairly close punctures, armed with 5 strong sharp teeth; *clypeus* distinctly carinate; *frontal area* triangular, smaller and less

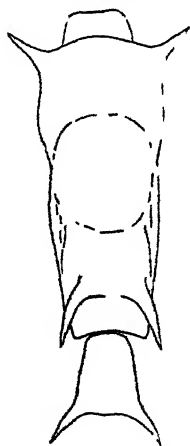
distinctly defined; the two projections or tubercles on vertex of head less prominent. *Thorax* with *pronotum* more convex. and with pronotal spines considerably more

Fig. 2.



Thorax and petiole of *Polyrhachis (Myrmhopla) serripinosa* Latr.

Fig. 3.



Thorax and petiole of *Polyrhachis (Myrmhopla) aureovestitus* Donis.

curved inwards; *epinotal* spines less curved downwards; *petiole* with spines straighter and also less curved downwards.

Long. 13 mm.

Described from a number of workers taken by Miss L. E. Cheesman in Dutch New Guinea, Mt. Nomo, S. of Mt. Bougainville. 600-1500 ft., "in a carton nest on under side of trees," ii. 36.

Type in B.M. Coll.

This insect comes in the *sexspinosa* group, and near to that species, but is quite distinct, as has been shown in the description and also by the figures. It is also allied to *aureovestitus* Donis., but the sculpture, shapes of spines, etc. are quite different.

Polyrhachis (Cyrtomyrma) rastellata Latr.

var. *nomo*. var. nov.

♀. Black shining, insertions of the antennæ, base of trochanters and of femora narrowly, spurs and claws reddish yellow, legs dark brown to black. The reticulation and small punctures are not as distinct as in *rastellata*, clothed with very fine, short, not close decumbent yellowish hairs.

Head broad, massive, broader than thorax, cheeks somewhat more rounded than in *rastellata*, posterior angles not distinct, posterior border not quite as deeply emarginate as in *rastellata*. *Thorax* broad, massive, convex; *meso-epinotal* suture not indicated; *scale* with four pointed teeth, the outer pair being longer and sharper than in *rastellata* and the inner pair less close and sharper.

Long. 5-5.5 mm.

Described from a number of workers taken by Miss L. E. Cheesman, Dutch New Guinea, Mt. Nomo, S. of Mt. Bougainville. 600-1500 ft., ii. 36.

This new variety comes in my Group 2, shoulders rounded, and epinotum unarmed (Ann. & Mag. Nat. Hist. (s. 11) i. p. 254 (1938).

Tribe LASIINI Ashmead.

Paratrechina (Nylanderia) lecamopteridis, sp. n.

♀. Light dirty brownish yellow, antennæ and legs lighter; clothed with fine, close, light yellow pubescence and sparse scattered outstanding hairs, somewhat shining, extremely finely punctured.

Head longer than broad, slightly narrower in front

than behind, posterior border excised, posterior angles rounded; *mandibles* shining, armed with four sharp teeth; *clypeus* transverse, convex, widely rounded anteriorly, subcarinate in centre; *frontal area* indistinct; *frontal furrow* replaced by a short carina; *eyes* rather large, situated before centre of sides of head, with rather coarse facets; *antennæ* with scape not extending beyond posterior border of head by more than one-fifth of its length, *funiculus* with 2nd, 3rd, and 4th joints as broad as long, last joint long, pointed, somewhat compressed, longer than the two preceding joints taken together. *Thorax* short, convex, slightly constricted in middle; *pronotum* transverse, anterior angles rounded; *mesonotum* with anterior border rounded; *meso-epinotal* suture very marked; *epinotum* with very short dorsal surface, *declivity* long and concave; *scale* of *petiole* small, narrow, inclined forward; *gaster* slightly longer than thorax, sides rounded, anterior border excised.

Long. 1.6–1.8 mm.

Described from a number of workers taken by Miss L. E. Cheesman in the rhizome of a fern (*Lecanopteris* sp.), North-West Dutch New Guinea, Waigeu Is., 2500 ft., iv. 1938.

Type in B.M. Coll.

This species comes nearest to *P. (N.) minutula* Forel, but differs in the length of the scape and in other structural characters.

It is difficult to understand why Forel, when describing *P. (N.) atomus* from the Bismarck Archipelago [Mitt. Zool. Mus. Berlin, ii. p. 25 (1901)], should have described *minutula*, in a foot-note from New South Wales, and treated *atomus* as a race of that species. According to the characters he gives I should consider *atomus* to be a good species; it is smaller, the colour is different, and the length of the joints of the antennæ are not the same.

Paratrechina (Euprenolepis) nuggeti, sp. n.

Large ♂. Brownish yellow, gaster darker, antennæ and legs yellow, funiculi, palpi, and tarsi lighter, whole body including head shining, furnished with outstanding blackish hairs or bristles, which are numerous though not close, not present on the epinotum and petiole, the funiculi, palpi, and last joints of the tarsi clothed with fine light

yellow pubescence and short decumbent hairs. There are no decumbent hairs or pubescence on the gaster or apex of scapes and tibiæ, as in Viehmeyer's *P. (E.) helleri*. Head finely reticulated, rest of body smooth and shining.

Head about as broad as long, and almost circular when seen from above in the largest ♂, getting slightly longer as the ♀ decrease in size, slightly narrower anteriorly than posteriorly, posterior border slightly excised; *mandibles* long, armed with six sharp teeth, the apical one longest the 2nd and 4th being smaller than the rest, the latter smallest of all; *clypeus* transverse, convex; *frontal area* and *furrow* indistinct; *antennæ* with *scape* extending beyond the posterior border of the head by half its length; 2nd joint of *funiculus* about two and a quarter times as long as broad, 3rd and following joints about three and a half times as long as broad. *Thorax* long, narrowest at base of mesonotum; *pronotum* narrowed anteriorly, sides rounded; *mesonotum* a little longer than broad, rounded, convex; *metanotum* about a quarter as long as mesonotum; *epinotum* convex, rounded, angle between dorsal surface and declivity not marked, not higher than pronotum; *scale of petiole* long, inclined forward, slightly excised on its upper edge; *gaster* oval.

Long. 4.2 mm.

Small ♀. Colour, sculpture, outstanding hairs, pubescence as in large ♀. *Head* slightly longer in proportion to its breadth than in the latter; it is certainly not much longer than broad, as in Viehmeyer's *helleri*; as broad anteriorly as posteriorly.

Long. 3.7 mm.

Described from a number of workers taken by Miss L. E. Cheesman in Papua, Kokoda, 1200 ft., ix. 33, and Mafulu, Wharton Range, 4000 ft., xii. 33. The latter were nesting in a clay bank, with a carton tunnel along a root.

Type in B.M. Coll.

This species comes nearest to Viehmeyer's *P. (E.) helleri* [Arch. f. Naturg. lxxix. Heft. 11, p. 41 (1913)], but differs from it in structure, pubescence, etc.

Named after Miss Cheesman's Papuan collector, "Gold Nugget."

IX.—*Entomological Expedition to Abyssinia, 1926-7.*
Coleoptera. Colydiidæ. By H. E. HINTON, Ph.D.,
 British Museum (Natural History).

THIS paper deals with the Colydiidæ collected in Abyssinia in 1926 by Dr. Hugh Scott and Mr. J. Omer-Cooper. Mr. G. J. Arrow* has already dealt with one of the species (*Euxestoxenus ovalis* Arrow) collected by this Expedition, and the remainder of the collection, consisting of 12 species represented by 40 specimens, is reviewed here. In addition to these, one new species, *Cerylon hera*, sp. n., is described from material which has been in the British Museum since many years before the Expedition took place. Until now only about nine species of Colydiidæ have been recorded from Abyssinia, so that the following list more than doubles the number of species known from that country:—

1. <i>Lasconotus obscurus</i> , sp. n.	3
2. <i>Cicones squamosus</i> Grouvelle	6
3. <i>Neotrichus cheops</i> , sp. n.	4
4. <i>Rhopalocerus anytus</i> , sp. n.	1
5. <i>Bothrideres festus</i> , sp. n.	1
6. <i>elicius</i> , sp. n.	1
7. <i>Cerylon omer-cooperi</i> , sp. n.	5
8. <i>hera</i> , sp. n.	1
9. <i>merella</i> , sp. n.	2
10. <i>nomia</i> , sp. n.	1
11. <i>serum</i> , sp. n.	2
12. <i>Philothermus scotti</i> , sp. n.	13
13. <i>Lapethus sparsus</i> , sp. n.	1

Total number of specimens examined. . . 41

(The names *cheops*, *anytus*, *elicius*, *hera*, *merella*, and *nomia* are proper names, taken at random from a classical dictionary. They are not intended to have any meaning, and they are nouns, not adjectives, so that their terminations cannot be varied.)

Brief remarks on biogeographical relationships will be found under the headings of genera and species.

* Arrow, G. J., "Notes on some Clavicorn Coleoptera and Descriptions of a few new Species and Genera," *Ann. & Mag. Nat. Hist.* (10) **xx.** pp. 101-113, 1937.

[COLLECTOR'S NOTE.—In view of the well-known association of Colydiidæ with primeval forest, it may be noted that all the twelve species collected by the Expedition were discovered in ancient forests. Ten of them were found in Jem-Jem Forest (8000 to 9000 feet), where the growth of giant Junipers and *Podocarpus*, as well as other trees, is very dense; the remaining two were taken at an altitude of about 9000 feet in the forest-belt on Mount Chillálo, a dense mixed forest, but one in which the very large trees have mostly disappeared and been replaced by secondary growth. In three of the species from Jem-Jem Forest (*Cicones squamosus*, *Neotrichus cheops*, and *Bothrioderes festus*) some specimens at least were found under the bark of resinous acacias, while the two examples of *Cerylon merella* were taken from decayed parts of a tree-euphorbia. The single specimen of *Rhopalocerus anytus* was found in decaying wood; I have no record of its having been in company with ants, though the European *R. rondanii* is usually associated with *Lasius brunneus* (Reitter, Fauna Germanica, Käfer, iii. p. 109, 1911).—HUGH SCOTT.]

Specimens of all the species, including the *types* of the new species, are in the British Museum.

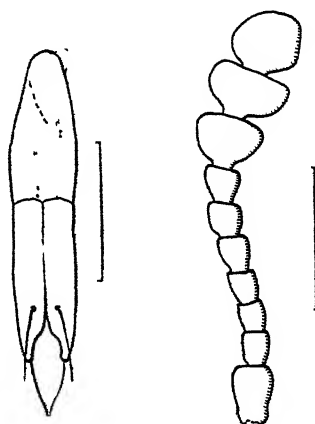
For figs. 6, 10, 11, and 13 I am indebted to Miss O. F. Tassart. Other illustrations were drawn by me with the aid of a camera lucida; lines next to figures refer to a length of 0.20 mm., unless otherwise indicated.

Lasconotus obscurus, sp. n. (Figs. 1 & 2.)

Male.—Length, 2.89 mm.; breadth, 0.90 mm.

Elongate, subparallel, moderately convex. Cuticle feebly shining, brownish-piceous. Head with antennæ as figured (fig. 2). Eyes finely setose. Lateral margins moderately strongly flexed upwards; middle of head opposite posterior third of eyes transversely and feebly gibbous; anterior margin, when seen from front, very shallowly, arcuately emarginate for entire breadth. Surface with prominent, round, flat-topped granules, which are usually distinctly coarser than facets of eyes or about 0.027 mm. broad and are usually separated by one-fourth to one-half diameter; granules on region behind eyes finer and less prominent; granules on anterior

third less prominent than those of middle region and frequently only about half as coarse; from the middle of each granule arises a short, testaceous, suberect seta. *Pronotum* with broadest point, which is across apical fourth, as broad as long (0.65 mm.) and base broader than apex (0.60 mm. : 0.54 mm.). Anterior margin very feebly sinuate at middle and moderately deeply and broadly sinuate on each side behind eye before apical angle; anterior angles rectangular, feebly rounded. Sides subparallel: feebly, broadly sinuate at apical two-fifths. Base broadly and strongly rounded; basal angles obtuse,



Lasconotus obscurus.

Fig. 1.—Dorsal view of male genitalia.

Fig. 2.—Antenna; basal segment not shown.

indistinct. Disk feebly and broadly depressed on most of middle apical half; each side of middle with a prominent, nearly complete carina which extends inwards on basal two-fifths and then curves around apical depression, where it is less prominent than elsewhere; at apex the median carinae are slightly nearer each other than at base; at side parallel to lateral margin with a very prominent and broad carina on apical two-thirds, this carina extending slightly inwards and becoming obsolete from basal third to basal sixth. Surface sculptured

like head. *Elytra* nearly three times as long as pronotum (1.86 mm. : 0.65 mm.) and very feebly broadened to broadest point at about apical third (0.90 mm.). Each elytron with a prominent and sharp carina on third, fifth, seventh, and eighth intervals, and on posterior six-sevenths the sutural interval is moderately raised. On basal seventh there is a row of punctures between first stria and suture; stria punctures on basal half of disk deep, round, about as broad as intervals, and separated longitudinally usually by one diameter; between each pair of punctures is a low, longitudinal tubercle which is generally about twice as long as broad. *Scutellum* subquadrate, strongly convex. *Prosternum* coarsely, confluent punctate. *Hypomera* rugulose and with a few indistinct tubercles. *Metasternum* with median longitudinal line narrow, deep, and complete; surface with dense, shallow, irregular punctures which become much finer posteriorly. *Abdomen* with surface of sternites sculptured like anterior region of metasternal disk, but apically and towards sides with low, irregularly shaped granules which are about as coarse as facets of eyes. *Genitalia* (fig. 1) as figured.

Female.—Externally similar to male, but the only specimen is slightly larger than the male type (3.4 mm. : 2.89 mm.).

Loc. Abyssinia: Mt. Chillálo, in forest, ca. 9000 ft., 12. xi. 1926, 1 ♂ (*type*) and 1 ♂, 1 ♀ (*paratypes*).

Of the 35 known species of *Lasconotus* all are American except *L. martini* Grouvelle of Natal and *L. jelskii* (Wankow) of North-Western Europe. From *L. martini* the new species may be distinguished by having four instead of three carinæ on each elytron and from *L. jelskii* by the presence of long tubercles between the elytral stria punctures.

Cicones squamosus Grouvelle (1896). (Figs. 3 & 4.)

Loc. Abyssinia: between Addis Alam and Jem-Jem Forest, 7000–8000 ft., 20. ix. 1926, under bark of growing and resin-bleeding *Acacia* *, 4 ex. (*Scott*); near Jem-Jem Forest, 20. ix. 1926, 2 ex. (*Omer-Cooper*).

* [As this paper contains several references to specimens taken under bark of *Acacia*-trees, it may be noted that, on the labels attached to the specimens, "*Mimosa*" was printed: this is not botanically accurate, and some species of thorny *Acacia* is meant in every case.—*EVAN SORR.*]

This species was described from specimens collected by Raffray in Abyssinia and Zanzibar, and the series before me agrees well with the original description except for size. Grouvelle's specimens were 2-3.5 mm. long, whereas those before me are 3.5-4.5 mm. long. I have not found any good external differences between this species and *C. africanus* Grouvelle, though these two may be distinguished at once by the structure of the male

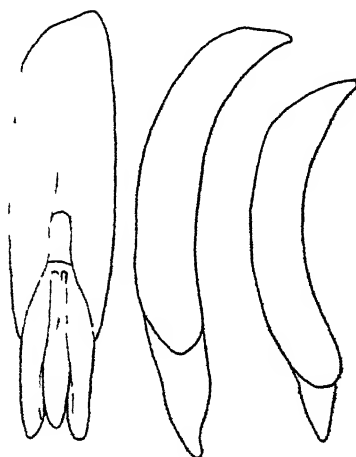


Fig. 3.—Dorsal view of male genitalia of *Cicones squamosus*.

Fig. 4.—Right lateral view of same.

Fig. 5.—Right lateral view of genitalia of *C. africanus*.

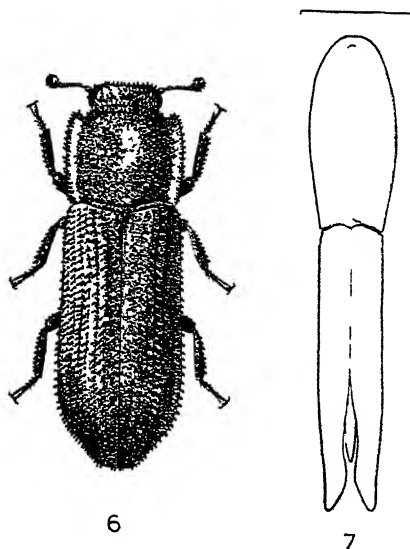
genitalia (*vide* figs. 3-5). The armature of *C. africanus* figured is that of a co-type in the British Museum, from Haut Sénégal : Badoumbé, i. v. 1882 (*Nodier*).

Neotrichus cheops, sp. n. (Figs. 6 & 7.)

Male.—Length, 4.5 mm. ; breadth, 1.37 mm.

Body parallel, moderately strongly convex. Cuticle feebly shining, colour black to dark rufo-piceous ; antennæ, mouth-parts, and legs paler rufo-piceous. *Head* moderately convex but feebly depressed on each side near eye ;

surface with round to oblong, very prominent granules which are about twice as coarse as facets of eyes and are confluent to being usually separated by about half a diameter; from top of each granule arises a stout, club-shaped, erect to suberect, testaceous seta which is about as long as its respective granule. Antenna with second segment twice as long and twice as broad as third; third segment as narrow as fourth and about a third longer (0.08 mm. : 0.05 mm.); segments four to nine progressively broader and shorter, so that ninth is distinctly



Neotrichus cheops.

Fig. 6.—Dorsal view to show general appearance.
Fig. 7.—Dorsal view of male genitalia.

broad than long. Clypeus with anterior margin truncate at middle and moderately broadly and deeply sinuate on each side; surface with granules less prominent, finer, and slightly sparser than those of head. *Pronotum* with broadest point, which is across apical third, broader than long (1.28 mm. : 1.23 mm.) and base broader than apex (1.15 mm. : 0.98 mm.). *Pronotum* with shape and impressions as figured (fig. 6). Surface sculptured like head but with granules slightly denser. *Elytra* more

than twice as long as pronotum (2.90 mm. : 1.23 mm.). Each elytron at base with an accessory stria of six punctures between first and second striæ. Strial punctures deep, more or less round, about as broad as intervals, and longitudinally separated by one to one and a half diameters: longitudinally between each pair of strial punctures with a very prominent carina which is sometimes tuberculiform, and from centre of each carina arises a stout, erect, club-shaped, testaceous seta which is about as long as carina. *Scutellum* flat, nearly round, about as broad as long (0.109 mm.) and with surface coarsely rugose. *Ventral surface* with prosternum, metasternum, and ventral abdominal sternites with round to irregular tubercles, which are about 0.03 mm. broad (slightly finer than those of pronotum) and are usually separated by one-fourth to one-half diameter; on metasternum and abdominal sternites granules are low, often nearly flat-topped; from posterior side of each granule arises a fine, straight or slightly club-shaped, recumbent to suberect, testaceous seta which is about as long as the granule from which it arises.

Female.—Externally similar to male.

Loc. Abyssinia: Jem-Jem Forest, x. 1926, 1 ♂ (*type*) and two paratypes (*Omer-Cooper*); the same forest, ca. 9000 ft., under bark of decaying *Acacia*, 1 ex. (*Scott*).

This is the third * African species of *Neotrichus* to be described, and the three may be distinguished as follows:—

- | | |
|--|--|
| 1. Each elytron without an accessory stria at base. Tanganyika Territory | [(1908).
<i>N. filiformis</i> Grouv. |
| Each elytron with an accessory stria at base between first and second striæ ... | 2. |
| 2. Species large, 4.5 mm. Sides of pronotum near apical angles at most slightly more broadly dilated than near base. Abyssinia | <i>N. cheops</i> , sp. n. |
| Species small, 3.5–4.0 mm. Sides of pronotum near apical angles with dilation half again as broad as at base. Tanganyika Territory | [(1908).
<i>N. eichelbaumi</i> (Grouv.) |

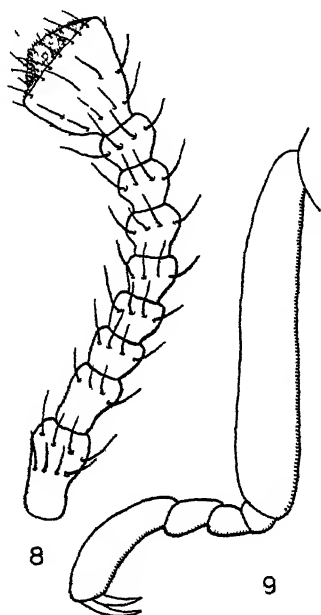
Rhopalocerus anytus, sp. n. (Figs. 8 & 9.)

Length, 2.6 mm.; breadth, 1.1 mm.

Obovate, moderately convex. Cuticle moderately shining, rufo-piceous. *Head* with margin above antennal

* I have recently had the opportunity of examining co-types of *Lasconotus eichelbaumi* Grouvelle (1908), and I find that this must be referred to the genus *Neotrichus* Sharp.

base broadly and strongly convex ; with a deep, median longitudinal, parallel-sided channel which is 0.035 mm. broad and extends to a point opposite posterior base of antenna : surface usually smooth. Antenna (fig. 8) as figured. Clypeus with anterior margin nearly truncate ; surface without distinct punctures. *Pronotum* with broadest point, which is at basal two-fifths, broader than long (0.82 mm. : 0.76 mm.) and base broader than



Rhopalocerus anytus.

Fig. 8.—Antenna ; basal segment not shown.

Fig. 9.—Hind tibia and tarsus.

apex (0.76 mm. : 0.73 mm.). Apical angles feebly produced and very feebly acute ; basal angles not produced, nearly rectangular. Pronotum with median longitudinal impression deep, nearly twice as broad as scutellum, deepest on middle of disk, extending from base to anterior sixth, and near base suddenly broadened ; at base in middle of median impression there is a short longitudinal carina ; at sides of median impression there is a carina

composed of close and large tubercles, this carina being much more distinct on basal fourth than elsewhere; on basal two-thirds, more or less parallel to inner carina, are two other similar carinæ, separated from each other by a distance equal to breadth of scutellum; at apical two-fifths parallel to outer (third) carina is a short fourth carina. Surface between depressions and between carinæ nearly smooth: surface between lateral margin and outer carina smooth, but with a deep depression at middle and again at base. *Elytra* more than twice as long as pronotum (1.72 mm. : 0.76 mm.). Humeri feebly gibbous. Disk with deep striate punctures which are about as broad as intervals and are separated longitudinally usually by one diameter: longitudinally between punctures with oblong or nearly round granules which are feebly to strongly convex, 0.03 mm. to 0.07 mm. broad, and each has on its posterior margin a broad, short seta: towards sides and apex punctures become shallower and sparser. *Ventral surface* usually with round, deep punctures which are 0.027–0.05 mm. broad and are separated by one-half to three diameters.

Loc. Abyssinia: Jem-Jem Forest, ca. 8000 ft., 7. x. 1926, from decaying wood, 1 ex. (*Scott*).

This is much more closely related to *R. africanus* Grouvelle, from the Belgian Congo, than to any other species. From *africanus* it may be distinguished by having the sides of the pronotum between lateral margins and outer carinæ smooth instead of "marginés, impressions contiguës, profondes et irrégulières."

The four species of *Rhopalocerus* may be divided into two distinct groups on the basis of the structure of the pronotum. In both *R. africanus* Grouv. and *R. anytus*, sp. n., the pronotum is longitudinally carinate and nowhere distinctly punctate, whereas in *R. rondanii* Villa of the Palæarctic region and *R. parallelus* Grouv. of the Oriental region the pronotum is without carinæ and is everywhere very coarsely and densely (frequently confluent) punctate.

BOTHRIDERES Erichson.

Only a single species, *B. confossicollis* Fairmaire, of this genus has been recorded from Abyssinia. In the present collection there are two new species, each represented

by a single specimen. The three Abyssinian species may be distinguished as follows:—

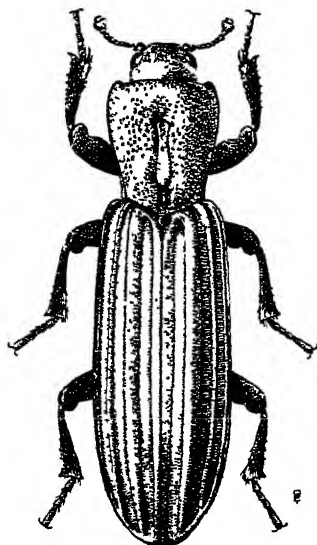
1. Elytra with third interval flat or nearly so on middle two-thirds [Fairmaire.
B. confossicollis
- Elytra with third interval strongly convex or carinate for its entire length..... 2.
2. Species large, 6.0 mm. Pronotum with median impression bounded by a deep channel (fig. 10). Elytra with fifth interval joined to seventh before apex; first, second, and third striae deep and distinct. Lateral carinae of first abdominal sternite absent *B. festus*, sp. n.
- Species small, 3.8 mm. Pronotum with median impression not bounded by a deep channel. Elytra with fifth interval not joined to seventh; first, second, and third striae absent. Lateral carinae of first abdominal sternite nearly complete. *B. elicius*, sp. n.

Bothrideres festus, sp. n. (Fig. 10.)

Length, 6.0 mm.; breadth, 1.83 mm.

Body parallel, moderately strongly convex. Cuticle moderately to strongly shining, colour moderately dark rufo-piceous. *Head* with deep, oval to navicular punctures, which are as long to slightly longer than facets of eyes and are confluent to separated by as much as one diameter; towards base these punctures become sparser, slightly finer, and often quite round; surface between granules densely, very lightly, and microscopically (scarcely visible at $\times 75$) alutaceous. Clypeus with fronto-clypeal suture feebly impressed and feebly curved; anterior margin, when seen from front, moderately shallowly and arcuately emarginate for its entire breadth; angle on each side obtusely angulate; surface with round punctures as coarse as those of base of head and nearly confluent to seldom separated by as much as one diameter; surface on extreme anterior part densely, transversely, and very finely alutaceous. Pronotum with broadest point, which is across apical eighth, not as broad as long (1.47 mm. : 1.64 mm.) and base slightly narrower than apex (1.09 mm. : 1.17 mm.). Pronotum with shape and impressions as figured (fig. 10). Surface punctate as anterior frontal part of head, but slightly though distinctly more coarsely so; surface between punctures densely, very lightly, and microscopically (scarcely visible at $\times 75$) alutaceous. *Elytra* nearly three times as long as pronotum (4.5 mm. : 1.64 mm.). First to third striae deeply and distinctly

impressed; fourth stria feebly impressed: outer striæ only represented by rows of punctures; stria punctures of basal half of disk deep, round, one-fifth to one-fourth as broad as intervals. and separated longitudinally by usually one and a half to two diameters. Intervals with first feebly convex except near apex, where it is strongly convex; third, fifth, seventh, and ninth sub-carinate. each being more strongly raised towards apex; first and third intervals extending to apex without joining



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Bothrideres festus.

others; fifth, seventh, and ninth joined together a short distance before apex and continuing as a single carina to apical margin. Surface of first, third, fifth, seventh, and ninth intervals with round to oval, moderately shallow punctures which are slightly finer than facets of eyes and are separated by one to five diameters; surface of flat discal intervals impunctate. *Abdomen* with lateral carinæ of first sternite absent. *Legs* with first tarsal segment distinctly shorter than combined length of two following.

Loc. Abyssinia : Jem-Jem Forest, ca. 9000 ft., 1. x. 1926. under bark of decaying Acacia, 1 ex. (*type*) (*Scott*).

Bothrideres elicius, sp. n. (Fig. 11.)

Male.—Length. 3·8 mm. ; breadth, 1·31 mm.

Body parallel, moderately strongly convex. Cuticle moderately to strongly shining, colour moderately dark rufo-piceous. *Head* between eyes with moderately shallow, round to navicular punctures which are about half again as coarse as facets of eyes and are contiguous to separated by nearly one diameter ; surface between punctures nearly smooth ; on basal half of head with punctures at sides separated by one diameter and absent on middle ;



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Bothrideres elicius.

surface on basal half of head transversely, densely, microscopically alutaceous. Clypeus with fronto-clypeal suture finely impressed, distinct, and feebly curved ; anterior margin, when seen from front, nearly truncate and angle on each side feebly rounded ; surface with round to feebly oval punctures which are as coarse to slightly coarser than facets of eyes and are separated by one-fourth to one diameter ; surface between punctures nearly smooth but on an extreme anterior belt with numerous microscopic (about a fourth as coarse as facets of eyes) punctures. *Pronotum* with broadest point, which is

across apical seventh, not as broad as long (0.82 mm. : 1.01 mm.) and base slightly narrower than apex (0.65 mm. : 0.71 mm.). Pronotum with shape and impressions as figured (fig. 11). Surface with round to oval, moderately deep punctures which are often 0.054 mm. broad (or are about three times as coarse as facets of eyes) and are contiguous to separated by nearly half a diameter; on middle between basal eighth and basal two-fifths without punctures on bottom of depression; surface between coarse punctures nearly smooth or with a few microscopic punctures. *Elytra* more than twice as long as pronotum (2.32 mm. : 1.01 mm.). Striæ absent but usual (strial) rows of punctures present: strial punctures on basal half of disk deep, round to oval, three-fifths to as broad as intervals, and separated longitudinally by one-third to one diameter. Third, fifth, seventh, ninth, and eleventh intervals sharply carinate; first interval moderately strongly raised but flat on top; third and fifth ending just before apex, and eleventh extending to a point opposite posterior margin of second abdominal sternite; seventh and ninth extending to apical margin but joined together just before apex. Surface of flat intervals smooth, feebly shining, and in some lights appearing oily; surface of raised intervals with round to oval punctures which are about as coarse as facets of eyes and are confluent to separated by two diameters. *Abdomen* with lateral carinæ of first sternite narrow, prominent, extending nearly to apical margin, and on caudal two-thirds nearly parallel. *Legs* with first tarsal segment distinctly shorter than combined length of two following.

Loc. Abyssinia: Jem-Jem Forest, x. 1926. 1 ♂ (*type*) (*Omer-Cooper*).

CERYLON Latreille.

Only one * species of this genus has been recorded from Abyssinia, *C. raffrayi* Grouvelle (1896). About 91 species of this cosmopolitan genus have been described, the Ethiopian and Oriental regions being particularly rich in species.

* *Cerylon striolatum* Grouv., *C. infimum* Grouv., and *C. alluaudi* Grouv. were described from specimens from the Ivory Coast: Assinie, 1886 (*C. Alluaud*). Hetschko (1930) incorrectly records these species from Abyssinia.

A Key to the Abyssinian Species of Cerylon.

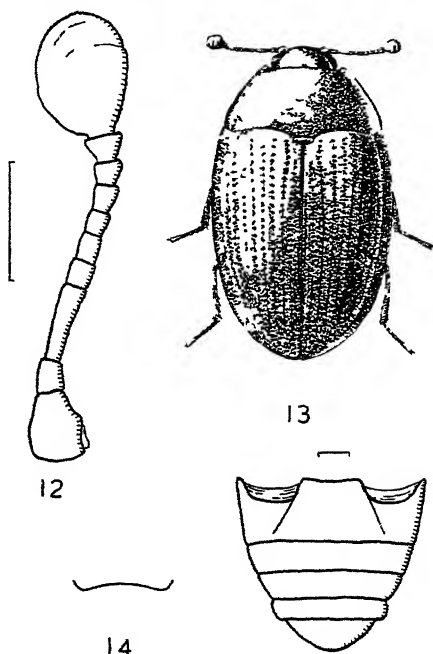
1. Body broadly oval. Lateral margins of pronotum and elytra broadly dilated and flexed upwards. Lateral margins of fourth abdominal sternite strongly produced outwards (fig. 15) *C. omer-cooperi*, sp. n.
- Body subparallel. Lateral margins of pronotum and elytra not dilated. Lateral margins of fourth abdominal sternite not produced 2.
2. Each elytron with six striæ. All tarsi 4-segmented 3.
- Each elytron with seven striæ. All tarsi 3-segmented 4.
3. Antenna with second segment much shorter than third (fig. 16). Clypeus with anterior margin at middle very deeply and narrowly emarginate (fig. 17). Each elytron with base of second stria nearer to suture than is side of scutellum. Ventral surface with erect hairs which are not more than half again as long as punctures. First abdominal sternite with sulci subparallel and extending to caudal tenth of segment ... *C. hera*, sp. n.
- Antenna with second segment as long as third (fig. 18). Clypeus with anterior margin at middle broadly and arcuately emarginate (fig. 19). Each elytron with base of second stria further from suture than is side of scutellum. Ventral surface with erect hairs which are usually two or three times as long as punctures. First abdominal sternite with sulci widely diverging posteriorly and confined to basal three-fifths *C. merella*, sp. n.
4. Species large, more than 3.0 mm. Antenna with second segment much shorter than third (fig. 20). Pronotum on basal two-thirds with a broad and very shallow impression on each side; surface on basal fourth at middle sides with a group of about 10 punctures which are two to three times as coarse as facets of eyes. First abdominal sternite with lateral sulci confined to basal fourth; middle of fourth abdominal sternite broadly depressed. Front tibia with outer subapical angle produced to form a long, slender tooth (fig. 22) [(1896).
C. raffragi Grouvelle
- Species small, less than 3.0 mm. Antenna with second segment as long or slightly longer than third (figs. 26 & 27). Pronotum with at most only basal fourth shallowly impressed on each side; surface with not more than four or five very coarse punctures all of which are confined to extreme base at middle sides. First abdominal sternite with lateral sulci extending to

- caudal fourth; middle of fourth abdominal sternite not depressed. Front tibia with outer subapical angle at most feebly produced 5.
5. Clypeus with middle of anterior margin deeply, arcuately emarginate (fig. 24)... *C. nomia*, sp. n.
- Clypeus at middle of anterior margin with a very deep, acute emargination (fig. 28). *C. serum*, sp. n.

Cerylon omer-cooperi. sp. n. (Figs. 12-15.)

Male.—Length, 2.68 mm. : breadth, 1.61 mm.

Body broadly oval, moderately convex. Cuticle strongly shining, colour brownish-piceous; antennal



Cerylon omer-cooperi.

Fig. 12.—Antenna.

Fig. 13.—Dorsal view of whole insect.

Fig. 14.—Anterior margin of clypeus seen from front.

Fig. 15.—Ventral view of abdominal sternites.

club, mouth-parts, and tarsi brownish-testaceous. *Head* with round punctures, which are slightly finer than facets of eyes and are separated usually by one to one and a half

diameters; surface between these punctures finely, longitudinally alutaceous, and also with a few slightly finer punctures. Antenna (fig. 12) as figured. Clypeus with anterior margin (fig. 14) very broadly, feebly, arcuately emarginate; surface sculptured like head. *Pronotum* with broadest point, which is at base, nearly twice as broad as long (1.34 mm. : 0.68 mm.) and base broader than apex (1.34 mm. : 0.71 mm.). Sides on basal three-fourths broadly dilated (fig. 13) and margins feebly flexed upwards. Surface evenly convex and sculptured like head, but near sides with punctures slightly coarser. *Elytra* more than twice as long as pronotum (1.91 mm. : 0.68 mm.). Sides (fig. 13) broadly dilated and margins strongly flexed upwards. Each elytron with seven well-impressed striæ and, parallel to seventh stria, with a non-striate row of about 7-10 punctures; discal striæ more or less parallel; sutural stria not distinctly impressed on basal fifth; stria punctures on basal half of disk round, moderately deep, and longitudinally separated by one to one and a half diameters. Intervals feebly convex; surface with round punctures about half as coarse as stria punctures and usually separated by two diameters. *Scutellum* flat, nearly three times as broad as long (0.07 mm. : 0.19 mm.), and surface sculptured like adjacent elytral intervals. *Prosternum* between front coxæ four times as broad as visible part of front coxa (0.08 mm. : 0.32 mm.). *Mesosternum* evenly convex, without a groove for reception of prosternal process. *Metasternal* disk feebly convex; median longitudinal line moderately finely impressed and confined to caudal half; without lateral discal carinæ. *Abdomen* with lateral sulci of first sternite broad, very widely diverging posteriorly, and extending to about apical fifth of segment; fourth sternite with sides strongly produced outwards (fig. 15). *Legs* with outer apical margin of front tibia evenly rounded. Tarsi 4-segmented.

Female.—Externally similar to male.

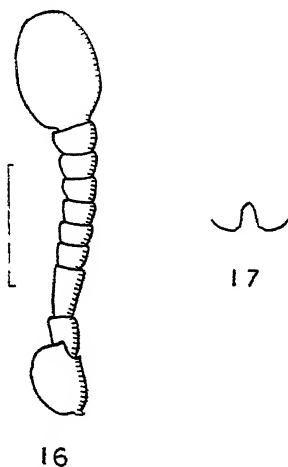
Loc. Abyssinia: Jem-Jem Forest, x. 1926, 1 ♂ (*type*) and 1 ♂, 3 ♀ (paratypes) (*Omer-Cooper*).

Its large size, broadly oval body, and strongly produced sides of the fourth abdominal sternite will serve to distinguish this from all other described species.

Cerylon hera, sp. n. (Figs. 16 & 17.)

Length, 2.33 mm. : breadth, 1.04 mm.

Body subparallel, dorsally moderately flat. Cuticle strongly shining, colour rufo-piceous; antennæ, mouth-parts, and legs slightly paler. *Head* with round punctures which are about two-thirds as coarse as facets of eyes and are usually separated by one to one and a half diameters; surface between punctures very lightly and finely alutaceous. Antenna (fig. 16) as figured. Clypeus with middle of anterior margin (fig. 17) narrowly and very deeply emarginate; surface sculptured like front of head.



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Cerylon hera.

Fig. 16.—Antenna.

Fig. 17.—Anterior margin of clypeus seen from front.

Pronotum with broadest point, which is across about basal third, broader than long (0.90 mm. : 0.71 mm.) and base broader than apex (0.87 mm. : 0.54 mm.). Pronotum evenly convex at sides but with middle of disk nearly flat. Surface with round, moderately deep punctures which are as coarse as facets of eyes and are usually separated by one to two diameters; surface between punctures smooth or sometimes microscopically (scarcely visible at $\times 75$) and moderately sparsely asperate; on each side of scutellum and contiguous to basal margin

are two or three oval punctures which are about twice as coarse as facets of eyes. *Elytra* more than twice as long as pronotum (1.58 mm. : 0.71 mm.). Disk nearly flat. Each elytron with six well-impressed striæ; sutural stria obsolete on basal fourth; second stria ending at a point opposite lateral fifth of scutellum; striæ two to four are noticeably curved inwards on basal third; stria punctures on basal half of disk shallow, indistinct (each puncture appearing as a crenation of the stria). and longitudinally separated by one to one and a half diameters. Intervals flat; surface with irregularly-shaped microscopic punctures which are separated by two to four diameters. *Scutellum* flat, much broader than long (0.164 mm. : 0.109 mm.), and surface sculptured like adjacent elytral intervals. *Prosternum* with process between front coxæ as broad as visible part of front coxæ (0.109 mm.); surface of prosternum and other parts of ventral surface with fine, erect hairs each of which is seldom (except on sides of prosternum) longer than the puncture from which it arises. *Mesosternum* with middle area flat to feebly concave. *Metasternal* disk very feebly convex, nearly flat; median longitudinal impression scarcely noticeable and confined to caudal half; with a short rudiment of a lateral carina on each side near anterior margin. *Abdomen* with lateral sulci of first sternite moderately broad, nearly parallel, and extending to caudal tenth of segment. *Legs* with outer subapical angle of front tibia feebly and narrowly produced. *Tarsi* 4-segmented.

Loc. Abyssinia (*Raffray*), 1 ex. (*type*) in Brit. Mus.

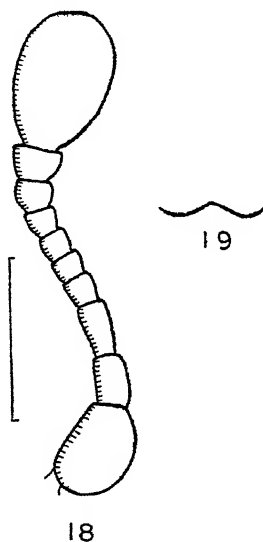
This is closely related to *C. alluaudi* Grouvelle, but may be distinguished by its larger size, relatively longer third antennal segment, nearly flat instead of deeply concave mesosternal disk, and its 4- instead of 3-segmented tarsi.

Cerylon merella, sp. n. (Figs. 18 & 19.)

Length, 2.19 mm.; breadth, 0.98 mm.

Body subparallel, moderately convex. Cuticle strongly shining, colour rufo-piceous; antennæ, mouth-parts, and legs slightly paler. Dorsal surface nearly glabrous; ventral surface for the most part with fine, erect hairs which are two to three times as long as the punctures from which they arise. *Head* with round punctures which

are about two-thirds as coarse as facets of eyes and are usually separated by one to two diameters: surface between punctures with a very fine alutaceous micro-sculpture. Antenna (fig. 18) as figured. Clypeus with anterior margin (fig. 19) broadly and deeply emarginate; surface sculptured like front of head. *Pronotum* with broadest point, which is across base, broader than long (0.84 mm.: 0.65 mm.) and base broader than apex (0.84 mm.: 0.52 mm.). Pronotum feebly but evenly convex except on base at lateral third, where it is feebly depressed. Surface with round punctures which are



Cerylon merella.

Fig. 18.—Antenna.

Fig. 19.—Anterior margin of clypeus seen from front.

about as coarse as facets of eyes and are usually separated by one and a half to two diameters; surface between punctures smooth to scarcely visibly alutaceous; extreme base on each side at lateral third with two or three much coarser punctures. *Elytra* more than twice as long as pronotum (1.47 mm.: 0.65 mm.). Disk moderately feebly convex. Each elytron with six feebly impressed striæ; sutural stria not distinctly impressed on basal fifth; base of second stria further from suture than side of

scutellum; striæ two to five are scarcely noticeably curved inwards on basal half; stria punctures on basal half of disk round, shallow but distinct, and longitudinally separated by usually two diameters. Intervals flat; surface with irregularly shaped, microscopic punctures which are separated by three to five diameters. *Scutellum* flat, nearly twice as broad as long (0.16 mm. : 0.09 mm.), and surface sculptured like adjacent elytral intervals. *Prosternum* with process between front coxæ slightly broader than visible part of front coxa (0.09 mm. : 0.08 mm.). *Mesosternum* with middle feebly convex. *Metasternum* with disk feebly convex; without a distinct median longitudinal line; without lateral carinæ. *Abdomen* with lateral sulci of first sternite moderately widely diverging caudally and confined to anterior half. *Legs* with outer subapical angle of front tibia obtuse and very feebly produced. *Tarsi* 4-segmented.

Loc. Abyssinia: Jem-Jem Forest, ca. 8000 ft., 5-7. x. 1926, from decaying parts of tree-euphorbia, 2 ex. (*type* and *paratype*) (*Scott*).

This appears to be more closely related to *C. alluaudi* Grouvelle than to any other species known to me. From *C. alluaudi* it may be immediately distinguished by its feebly convex instead of deeply concave mesosternal disk and widely divergent instead of nearly parallel sulci of the first abdominal sternite.

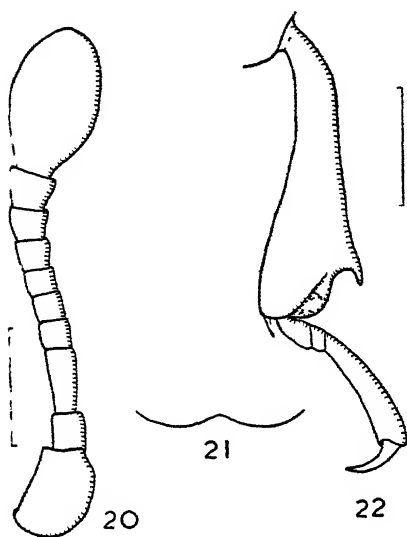
Cerylon raffrayi Grouvelle, 1896. (Figs. 20-22.)

No examples of this species, discovered in Abyssinia by Raffray, were obtained by the Expedition of 1926-7. Its characters are, however, given in the key above (p. 158), and figures of certain parts are inserted here.

Cerylon nomia, sp. n. (Figs. 23-26.)

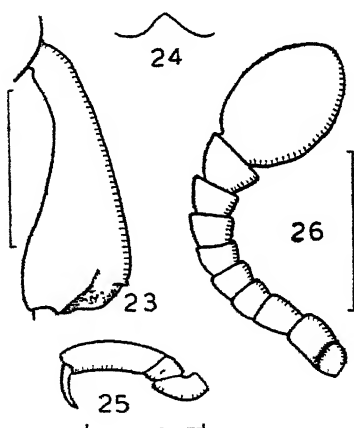
Length, 2.36 mm.; breadth, 0.98 mm.

Body subparallel, moderately feebly convex. Cuticle strongly shining, colour rufo-piceous; antennæ, mouth-parts, and legs slightly paler. Dorsal surface with very fine, erect, moderately sparse hairs which are usually not longer than the punctures from which they arise; ventral surface similarly clothed but with hairs of prosternum often slightly longer than punctures. *Head* with round punctures which are as coarse as facets of eyes and are



Cerylon raffrayi.

- Fig. 20.—Antenna.
 Fig. 21.—Anterior margin of clypeus seen from front.
 Fig. 22.—Front tibia and tarsus.



Cerylon nomia.

- Fig. 23.—Front tibia.
 Fig. 24.—Anterior margin of clypeus seen from front.
 Fig. 25.—Hind tarsus.
 Fig. 26.—Antenna; basal segment not shown.

usually separated by one to two diameters; surface between punctures smooth or nearly so. Antenna (fig. 26) as figured. Clypeus with anterior margin (fig. 24) deeply and more or less acutely emarginate; surface sculptured like head. *Pronotum* with broadest point, which is across basal third, broader than long (0.82 mm. : 0.69 mm.) and base broader than apex (0.79 mm. : 0.54 mm.). *Pronotum* with middle of disk evenly and very feebly convex. Surface with round moderately deep punctures, which are as coarse as facets of eyes and are separated usually by one to one and a half diameters; surface between punctures smooth; towards base of disk punctures become slightly but distinctly coarser; on extreme base at lateral third with two or three punctures, which are two to three times as coarse as facets of eyes. *Elytra* more than twice as long as pronotum (1.50 mm. : 0.69 mm.). Disk feebly convex. Each elytron with seven striæ, of which the first six are well impressed and the seventh is only very feebly impressed; sutural stria obsolete just before scutellum; second stria at base slightly further from suture than side of scutellum; striæ two to five only very feebly curved inwards on basal half; stria punctures on basal half of disk round, shallow but distinct, and longitudinally separated usually by two diameters. Intervals flat; surface of disk with a single, irregular, median row of microscopic punctures separated by about three to six diameters; surface between punctures smooth. *Scutellum* flat, broader than long (0.16 mm. : 0.09 mm.), and with surface sculptured like adjacent elytral intervals. *Prosternum* with process between front coxæ slightly broader than visible part of front coxa (0.09 mm. : 0.08 mm.). *Mesosternum* with anterior three-fifths feebly convex and caudal half flat to very feebly concave. *Metasternum* with disk feebly convex; median longitudinal line indistinct and confined to caudal fourth; lateral carinæ about as long as first antennal segment. *Abdomen* with lateral sulci of first sternite broad, subparallel (only feebly diverging caudally), and extending to apical seventh of segment. Fifth sternite with middle feebly and broadly depressed. *Legs* with outer subapical angle of front tibia (fig. 23) feebly produced. *Tarsi* (fig. 25) 3-segmented.

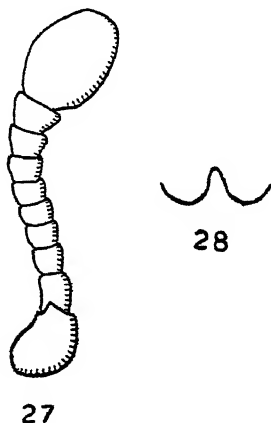
Loc. Abyssinia : Jem-Jem Forest. *ca.* 9000 ft., 24. ix. 1926. 1 ex. (*type*) (*Scott*).

This is close to no species known to me.

Cerylon serum. sp. n. (Figs. 27 & 28.)

Length. 2.29 mm. ; breadth. 0.98 mm.

Body subparallel, moderately convex. Cuticle strongly shining, colour rufo-piceous ; antennæ, mouth-parts, and legs slightly paler. Dorsal surface with sparse, erect, very fine (scarcely visible at 75) hairs ; ventral surface with the hairs longer and denser, those on sides of prosternum being as long as coarse punctures from which they



Cerylon serum.

Fig. 27.—Antenna.

Fig. 28.—Anterior margin of clypeus seen from front.

arise. *Head* with round, moderately shallow punctures which are slightly finer than to as coarse as facets of eyes and are separated by one and a half to two diameters ; surface between punctures smooth. Antenna (fig. 27) as figured. Clypeus with anterior margin (fig. 28) very deeply and narrowly emarginate ; surface sculptured like head. *Pronotum* with broadest point, which is across basal third, broader than long (0.83 mm. : 0.68 mm.) and base broader than apex (0.80 mm. : 0.54 mm.).

Pronotum feebly but evenly convex except at base on lateral third, where it is feebly depressed. Surface with round moderately shallow punctures, which are often slightly coarser than facets of eyes and are usually separated by one to two diameters; surface between punctures usually smooth; at extreme base on each side of middle with four oval much coarser punctures, the outer one being largest or all or nearly three times as long as an eye-facet. *Elytra* more than twice as long as pronotum (1.53 mm. : 0.68 mm.). Disk feebly convex. Each elytron with seven striæ, of which the first six are well impressed and the seventh is only feebly impressed; sutural stria obsolete for a short distance behind scutellum; second stria at base about as far from suture as side of scutellum; striæ two to five very feebly curved inwards on basal half; stria punctures on basal half of disk round, moderately shallow, and separated longitudinally by usually two diameters. Intervals flat; surface of each with a single irregular row of microscopic punctures which are separated by three to six diameters; surface between punctures smooth. *Scutellum* flat, broader than long (0.16 mm. : 0.109 mm.), and with surface sculptured like adjacent elytral intervals. *Prosternum* with process between front coxæ slightly broader than visible part of front coxa (0.109 mm. : 0.08 mm.). Mesosternal disk with anterior two-thirds moderately convex and posterior third flat or at most feebly concave. Metasternum with disk feebly convex; median longitudinal line nowhere distinct; lateral carinæ scarcely developed, not as long as first antennal segment. *Abdomen* with lateral sulci of first sternite broad, subparallel (only feebly diverging caudally), and extending to apical seventh of segment. Fifth sternite with middle broadly and shallowly depressed. *Legs* with outer subapical angle of front tibia very feebly produced. Tarsi 3-segmented.

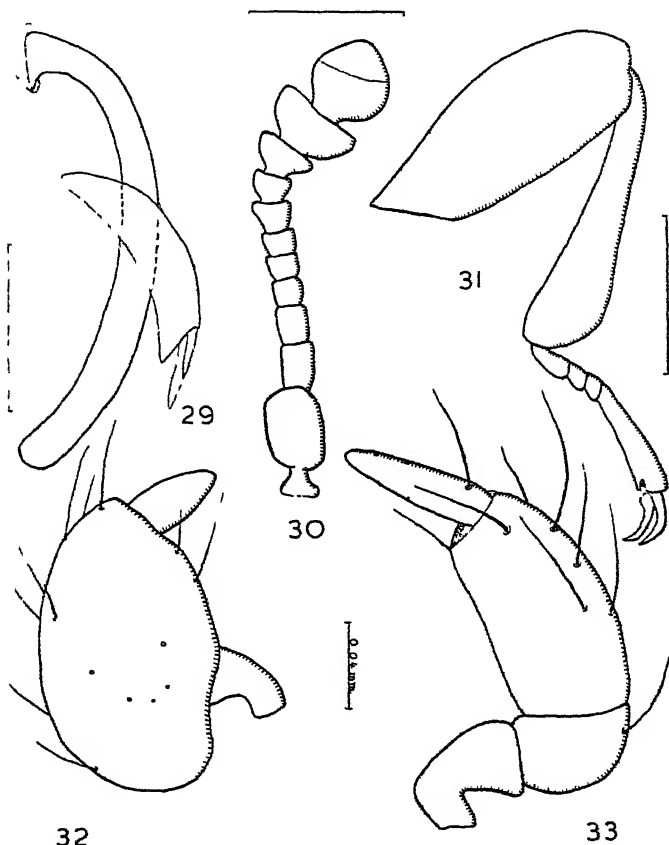
Loc. Abyssinia: Jem-Jem Forest, ca. 8000 ft., 2-3. x. 1926, from fungus, 1 ex. (*type*) (*Scott*); same locality, but collected at 9000 ft., 24. ix. 1926, 1 ex. (*paratype*) (*Scott*).

This is extremely closely related to *C. nomia*, but may be distinguished by its more deeply and narrowly emarginate anterior margin of the clypeus (*cf.* figs. 24 and 28).

Philothermus scotti, sp. n. (Figs. 29-33.)

Male.—Length, 1.78 mm.; breadth, 0.71 mm.

Subparallel, moderately convex. Cuticle shining, dark rufo-piceous; antennæ, mouth-parts, and legs paler rufo-piceous to brownish-piceous. Dorsal surface very sparsely



Philothermus scotti.

Fig. 29.—Left lateral view of male genitalia and spicule.

Fig. 30.—Antenna.

Fig. 31.—Hind femur, tibia, and tarsus.

Fig. 32.—Labial palp.

Fig. 33.—Maxillary palp.

pubescent with fine, erect, testaceous hairs. *Head* with round punctures very slightly coarser than facets of eyes

and usually separated by one to three diameters; surface between punctures very feebly, scarcely noticeably ($\times 75$). transversely alutaceous. Antenna as figured (fig. 30). Clypeus with anterior margin narrowly and deeply emarginate at middle; angle on each side broadly rounded: surface sculptured like head but with punctures sparser and much finer. *Pronotum* at broadest point, which is across apical fourth, broader than long (0.64 mm. : 0.54 mm.) and base broader than apex (0.63 mm. : 0.46 mm.); finely margined at sides and base; sides feebly arcuate, nowhere distinctly sinuate; base nearly straight, feebly and broadly sinuate on each side. Surface evenly convex; punctures round, distinctly coarser than facets of eyes or about 0.012 mm. broad, and usually separated by one and a half to two diameters; surface between punctures feebly alutaceous like head. *Elytra* slightly more than twice as long as pronotum (1.23 mm. : 0.54 mm.); at base very slightly broader than base of pronotum, gradually broadening posteriorly to broadest point (0.71 mm.), which is between basal third and basal two-fifths, and gradually and moderately feebly narrowed to apex. Striæ feebly impressed; discal stria punctures at base slightly coarser than those of pronotal disk, but becoming finer posteriorly, so that at apex they are no coarser than facets of eyes; stria punctures usually separated longitudinally by one to two diameters. Surface of intervals feebly alutaceous and with only a few microscopic punctures. *Scutellum* semicircular, broader than long (0.11 mm. : 0.06 mm.). *Ventral surface* with sides of prosternum and metasternum with round to oval punctures which are a third to occasionally twice as coarse as facets of eyes and are usually separated by one-fourth to one diameter. Abdomen with sides similarly but slightly more finely punctate; apical margin of fifth sternite deeply, arcuately emarginate at middle. *Genitalia* as figured (fig. 29).

Female.—Externally similar to male.

Loc. Abyssinia: Jem-Jem Forest, ca. 8000 ft., 25–29. ix. 1926. 1 ♂ (*type*), and 6 ex. (paratypes) (*Scott*); same locality, but collected 2–9. x. 1926, on fungus, 4 ex. (paratypes) (*Scott*); same locality, ix.–x. 1926, 2 ex. (paratypes) (*Omer-Cooper*).

This is related to the only Palæarctic species, *P. montandoni* Aubé, but may be distinguished by its relatively larger, narrower, and less convex body and its very sparsely instead of densely pubescent dorsal surface.

Twenty-five species of this widespread genus have been described, but of these none has previously been recorded from Tropical Africa.

Lapethus sparsus, sp. n.

Length, 1.69 mm. ; breadth, 0.87 mm.

Obovate, moderately strongly convex. Cuticle shining, rufo-piceous ; antennæ, mouth-parts, and legs paler and brownish-testaceous. Dorsal surface with sparse, fine, short, erect, testaceous hairs. Head with indistinct, microscopic punctures, usually separated by two or three diameters. Pronotum with broadest point, which is at base, broader than long (0.79 mm. : 0.60 mm.) and base broader than apex (0.79 mm. : 0.38 mm.). Sides broadly sinuate at basal third and obtusely angulate at middle ; apical margin with an extremely fine marginal stria ; base not margined, feebly and broadly sinuate on each side ; sides narrowly but distinctly more strongly margined than apex ; when viewed laterally the lateral margin is feebly arcuate at apical two-fifths and feebly oblique on basal two-fifths. Surface with punctures distinctly (about a fourth) coarser than those of head and usually separated by two to four diameters ; surface between these punctures with much finer, sparser punctures which are just visible at $\times 75$. Elytra twice as long as pronotum (1.20 mm. : 0.60 mm.) and feebly broadened to broadest point between basal third and fourth (0.87 mm.) and thence evenly narrowed to apex. Striæ absent ; stria punctures on disk round, shallow, very slightly larger than coarser ones of pronotum, one-fourth to one-seventh as broad as intervals, and separated longitudinally by three to five diameters ; towards apex these punctures become finer, so that at apical fourth they are not more than half as coarse as at base. Intervals flat ; surface punctate like head but more sparsely so. Prosternum with a fine, complete, lateral stria which is more or less parallel to what is probably the raised sternonotal suture ; surface punctate like head but anteriorly more

coarsely and densely so; surface between punctures feebly, microscopically alutaceous. Metasternum without a median longitudinal line; lateral carinæ distinct, feebly curved, and extending caudally to posterior fourth and outwards nearly to lateral margin; surface with punctures as coarse as anterior ones of prosternum and usually separated by two to four diameters; surface between these punctures very finely, longitudinally, and densely alutaceous. *Abdomen* with stria of first sternite broadly curved, extending posteriorly to posterior sixth of segment and outwards nearly to lateral margin. Surface of middle region of first sternite sculptured like metasternal disk but with punctures slightly finer; surface of sides of first and all of other sternites with punctures finer and with alutaceous microsculpture transverse instead of longitudinal.

Loc. Abyssinia: Mt. Chillalo, ca. 9000 ft., 13. xi. 1926, by sifting humus under tree in forest, 1 ex. (*type*) (Scott).

Seventeen species of *Lapethus* Casey have been described. Of these thirteen are American, chiefly Neotropical, two occur in New Caledonia, one in Madagascar, and one in the Seychelles Islands.

X.—*The Relationship of certain Variant Fossil Types of "Horn" to those of the Living Pecora.* By GUY E. PILGRIM, D.Sc., F.G.S.

ALTHOUGH the varying types of frontal appendage—"horns"—constitute one of the most important distinctions between the different families of the Pecora, yet much which concerns their ultimate origin and the exact relation in which they stand to one another is still problematical. During recent years considerable light has been thrown on the origin and development of the "horns" in the existing Giraffidæ, Cervidæ, Bovidæ, and Antilocapridæ by the histological studies of Boas, A. and K. Brandt, Duerst, Fambach, Nitsche, Rhumbler, Zietschmann, and many others on young and foetal stages of growth. We are led to conclude from Rhumbler's latest paper on the subject, in 1932-3, that the Pecoran

horn consists of three essential elements of quite distinct origin :—

(1) An epidermal portion, which in the Giraffidæ and Cervidæ is represented by the skin and its hair covering, and in the Bovidæ and Antilocapridæ by the corneous sheath.

(2) A subcutaneous portion, which in the Giraffidæ makes up almost the entire "horn," termed by Lankester (1907, p. 100) the ossicone, and remains separate from the frontal protuberance (3) up to a relatively advanced age, but eventually becomes ankylosed to it. In the Cervidæ and Bovidæ the corresponding element has been called the *os cornu*. Both (1) and (2) are epiphyseal in origin.

(3) is apophyseal, and is produced by the direct outgrowth of the frontal bone. In the Giraffidæ this constitutes but a small part of the "horn." Later in the life of the animal it becomes ankylosed to the ossicone, but the junction between the two parts occupies a single plane and has almost the character of an ordinary suture. In the Cervidæ and Bovidæ, on the contrary, the apophyseal outgrowth of the frontal encompasses and grows up beyond the *os cornu* quite early in the life of the animal, so that any individuality which the latter once possessed becomes entirely obliterated.

Disregarding the juvenile stage, and considering (2) and (3) as forming a homogeneous whole, which, in fact, is their condition in the adult, it would appear that the Giraffid and Cervid "horns" are almost identical. The difference between them lies in the periodical necrosis of the distal portion, antler, which is then shed and subsequently renewed in the Cervidæ. The base of the "horn," which varies in length in different lineages of the family, is known as the pedicle, and remains alive and covered by skin and hair continuously. This shedding of a part of the "horn" does not normally occur in the Giraffidæ, but according to Lankester (1907, p. 126) it is foreshadowed in the Okapi. In this animal he has observed that the tip of the ossicone for about half-an-inch becomes divested of skin and is marked off from the lower portion by one or more transverse fissures. He believes that this phenomenon represents an initial stage in the

fall of an antler, analogous to what generally takes place, but on a much larger scale, in the Cervidæ.

The Bovidæ and Antilocapridæ are distinguished from the Giraffidæ and Cervidæ by the replacement of the epidermis and its hair by a corneous covering, the horn-sheath, which in the existing Bovidæ is permanent but in *Antilocapra* is periodically shed and renewed.

Thus it seems evident that the Giraffid "horn" has remained closer to the primitive condition than that of the other families in question. From this primitive hypothetical stage it seems likely that every other type of Pecoran "horn" has been derived, the evolutionary changes involving not only the predominating influence of the apophyteal element but also the periodical renewal of portions of the "horn." The Bovidæ and Antilocapridæ are still further developed than the Cervidæ, inasmuch as the epidermal portion of the "horn" has become corneous. As to when and how these various stages originated we know nothing. Presumably a detailed histological examination of the fossil forms might throw considerable light on the problem. This has, so far as I am aware, not been attempted. Such research is more difficult to carry out than in the case of living species, since fossil foetal material is practically non-existent and even juvenile "horns" are scarce. At the same time one cannot help thinking that material suitable for the purpose might be available among the large collections of North America. In the present paper I propose to consider the superficial characters of certain peculiar fossil types of "horn," with the hope that an estimate of their true relationship to the living Pecoran families may be an aid to studies of the kind suggested.

Small animals with branching "horns" resembling those of the Cervulinæ, but without the burr which marks the junction between the permanent pedicle and the deciduous antler, have long been known from the Lower Miocene of the Sables d'Orléanais. These were described under the name of *Procervulus* by Gaudry (1878, p. 87), who regarded them as ancestral to the Middle Miocene *Dicroceros*, obviously a Cervuline deer, since the "horns" possessed a burr and were therefore deciduous. Gaudry suggested that the flow of energy (*sève ossifiante*) was less intense in the Lower than in the Middle Miocene,

and was therefore insufficient to renew the antler in *Procervulus* though adequate for that purpose in *Dicroceros*. This explanation seems rather far-fetched, and, furthermore, it is not easy to understand why the renewal of the antler, if advantageous, should have been delayed until it had reached such a high degree of complexity. Although it has been generally assumed that *Procervulus* is a Cervuline deer, no other explanation of the change from permanent to deciduous antlers has, so far as I am aware, been proposed, and one is inclined to suspect that the supposed Cervid affinity of *Procervulus* is illusory.

The material of *Procervulus* is still very scanty. From the same deposits teeth of a brachydont type like those of *Palæomeryx*, but without the typical *Palæomeryx*-fold in the lower molars, were referred to *Procervulus* by Stehlin (1925, p. 93), who also pointed out that the upper molars figured by Mayet (1908, p. 287) under the name of *Amphimoschus pontelevisensis* belonged here. Better material, as yet not fully described, was obtained by Dehm (1937, p. 365) from fissure deposits at Wintershof. Another Middle Miocene form from Europe, having "horns" with a longer pedicle and branching from a single point, without any evidence that they were ever shed, was separated from *Palæomeryx* by Roger (1904, p. 18) under the name of *Lagomeryx*.

An extremely illuminating suggestion has recently been made by Teilhard (1939, p. 269) in a paper describing some "horns" and teeth from the probably Tortonian beds of Shantung in China. Young (1937, p. 228) had previously described similar "horns" under the name of *Heterocemas*, for which he suspected a Merycodontid affinity. Teilhard showed that these were generically inseparable from the European *Lagomeryx*. The teeth are quite Palæomerycine in structure, and have the *Palæomeryx*-fold on the lower molars. Remarking on "the smooth surface of the 'horns' with numerous vermiculations left by blood-vessels," he considers "that this proves either the presence of a deciduous horny sheath or more probably a permanent skin, covering the non-deciduous bony antler." Teilhard evidently favours the latter explanation, since he suggests (p. 278) that such forms as *Procervulus* and *Lagomeryx* might be regarded as aberrant Giraffids, and that a special family

should be erected to contain them. Teilhard's view seems to me to be very near the truth, and I fully endorse his proposal that they should form a new family. For this the name *Lagomerycidae* might conveniently serve.

Yet a third genus might provisionally be included in the family. This is the curious form *Ulimacoceras*, described by MacInnes (1936, p. 521) from the Middle Miocene of Lake Victoria. The "horns" of this were evidently permanent, but differed from those of both *Procervulus* and *Lagomeryx* by possessing short, irregularly disposed offshoots, which varied in number. It may be remarked that this type of structure seems to be represented in a rudimentary stage in one member of the true Giraffidae, *Giraffokeryx* of the Middle Miocene of India. In this genus large rugose protuberances occur at the base of the simple "horn," which according to Colbert (1933, p. 2) may have been in life accessory knobs or branches.

Each one of these three genera thus displays a complexity of horn development which is attained in the Sivatheriinae alone of the true Giraffidae. The relation between the *Lagomerycidae* and the Giraffidae seems to me to be somewhat analogous to that between the Merycodontidae and the Antilocapridae, the former family, though appearing earlier, showing a greater complication in the "horn" structure.

It may be assumed that both the Giraffoid families were derived from a *Palæomeryx*-like hornless type, but it is obvious that between the hornless form and the complicated horned stage of *Procervulus* and *Lagomeryx* a stage with simple, unbranched non-deciduous "horns" must have intervened. Such a stage is unknown in Europe, *Procervulus* being evidently a migrant. There is, however, a strong presumption that the family originated in Central Asia, so that we might expect that it existed in the Oligocene or Lower Miocene of that region: faunas of that age are not as yet fully known there, so that direct proof is denied to us. The adjacent area of North America, however, contains two types, both known almost completely—*Dromomeryx* (Douglass, 1909, p. 457) and *Aletomeryx* (Lull, 1920, p. 83), from the Lower and Middle Miocene—which seem fairly satisfactorily to fill the intermediate position predicated. Frick (1937, pp. 40–187) has fully reviewed a vast amount of North American

material, which he has arranged in two divisions, *Dromomerycini* and *Aletomerycini*, both classed as *Cervidæ*. The former of these includes several genera and subgenera classified in four subfamilies. The most important are *Rakomeryx* Frick, *Cranioceras* Matthew, *Barbouromeryx* Frick, and *Drepanomeryx* Sinclair. The latter include *Sinclairomeryx* Frick and *Yamaceras* Frick. Scott (1895, p. 172) considered that the "horns" of *Dromomeryx* on account of their smoothness were permanently covered with skin. Lull (1920, p. 92) arrived at the same conclusion with regard to the "horns" of *Aletomeryx*, but in spite of this inclined to regard the genus as *Merycodontine*, an opinion in which Matthew concurred. Matthew (1915, p. 251, footnote: 1918, p. 218) suggested the relationship of *Dromomeryx* to the *Giraffidæ*, and to judge from its position on his chart of 1934, he had not discarded the idea up to the end of his life. Frick, both from his remarks (1937, p. 51) and from his conjectural restorations, seems to have considered that in life corneous appendages were borne on the "horns" as they are now preserved to us, but such an assumption seems to me to have been quite gratuitous, nor are his arguments for affinity with the *Cervidæ* convincing. In neither group were the "horns" branched, though in *Cranioceras* occipital horns also existed. In the *Dromomerycini* the "horns" generally tapered to a point. In *Drepanomeryx* and the *Aletomerycini* they have bulbous ends, so that they could hardly have possessed horns such as those of the *Bovidæ*. There is no evidence that any part of the appendage was shed in either group. If it were definitely known that these "horns" were structurally giraffid ossicones, no further proof of their giraffid affinity would be needed. It is true that Lull (1920, p. 92) states that "there is no evidence that the horns of *Aletomeryx* were derived from separate centres of ossification as in the giraffe," but without knowing whether Lull employed any special histological methods in his examination, we are not in a position to deny that an ossicone may have existed at any rate in a juvenile stage, any more than we are justified in denying it in the case of the *Lagomerycidæ* considered earlier in this paper.

Apart from the "horns" there are undoubtedly many features of the anatomy in regard to which

Dromomeryx, *Aletomeryx*, and their allies show a primitive condition approximating to what is found in a form like *Blastomeryx* (little except the dentition is known in the case of *Palæomeryx*). The following primitive characters may be mentioned :—

- (1) The brachydont dentition (in *Aletomeryx* less so).
- (2) The rugose enamel of the teeth.
- (3) The parallelism of the basicranial and basifacial axes.
- (4) The separation of the radius and ulna.
- (5) The retention of the lateral metapodials.
- (6) The retention of a long sabre-like upper canine (this is present in *Aletomeryx*, and though unknown in *Dromomeryx* probably existed, since Frick (1937, p. 128) records its presence in *Barbouromeryx*; it is also found in *Lagomeryx*).

(7) The presence of a *Palæomeryx*-fold in the lower molars is undoubtedly a primitive feature, but it seems to be variable, since *Dromomeryx* and *Lagomeryx* possess it, while *Procervulus*, *Aletomeryx*, and *Climacoceras* lack it. It is perhaps without the significance which it has generally been assumed to have.

The first three of these are still Giraffid characters; the last four are no longer so. Certain other characters of the group exhibit a progressiveness or a specialization which either exists equally in the Giraffidæ or foreshadows developmental trends which appear in that family. Among these are :

(1) The absence of a lachrymal fossa, found universally in the Cervidæ and the primitive Bovidæ, but absent in advanced Bovidæ, *Oioceros*, *Antilocapra*, and the Giraffidæ.

(2) The molarization of the premolars.

(3) The prolongation of the supraoccipital region so as to overhang the condyles considerably. This is a striking character of the Giraffidæ, and especially of *Giraffokeryx*.

(4) The tendency to a triangular cross-section in the "horn." This is distinctly indicated in *Giraffokeryx*.

(5) The great forward extension of the lachrymal and the jugal. In the Cervidæ both are short.

If the affinity suggested is the true one, then the American genera must be survivors of forms which existed

in the Oligocene and still await discovery, probably in Central Asia, since the more progressive *Procervulus* is Lower Miocene and, moreover, a migrant into Europe.

The origin of the deciduous antler of the Cervidæ from the hypothetical ancestral Giraffoid type of "horn" is at present obscure. The earliest form possessing true Cervid antlers is *Stephanocemas infans* (Stehlin, 1939, p. 178) from the Lower Miocene of the Sables d'Orléanais. The genus was founded by Colbert (1936) on a species from the Middle Miocene of Mongolia with complicated palmate antlers on a moderately long pedicle. Stehlin (1937, p. 193) generically identified with this a species from Statzling, and fully confirmed Colbert's opinion that the antlers were deciduous. *Dicroceros* from the Middle Miocene of Europe and Mongolia is clearly a Cervuline deer with simpler forked or dichotomously branched and burred antlers on a longer pedicle.

Hornless genera, *Dremotherium* and *Amphitragulus* of the U. Oligocene of Europe, and *Leptomeryx* and *Blastomeryx* of the L. Oligocene and L. Miocene respectively of North America, have been referred to the Cervidæ, but simple unbranched Cervid "horns," whether deciduous or not, have not been found fossil. The living brocket may be a survivor of such a form. We cannot entirely exclude the possibility that some Lagomerycid with simple, non-deciduous "horns" may have given rise to the deciduous Cervid antler, though both *Dromomeryx* and *Aletomeryx* seem to have proceeded too far in a Giraffoid direction to be the required ancestor. The reason for the shedding and renewal of the Cervid antler is equally problematical. Lankester's observations on the Okapi horn, referred to above (p. 173), suggest a possible initial stage of the process.

There remains for consideration the Bovoid "horn" as represented by the simple, unbranched, permanent horn-sheath of the majority of the Bovidæ and the branching, deciduous horn-sheath of the Antilocapridæ and probably of the Merycodontidæ, and its hypothecated derivation from the primitive Giraffoid type just described.

The structure and occurrence of the Merycodont "horn" has given rise to much speculation as to its meaning and the nature of the appendage in the living animal. Frick (1937, p. 280) has admirably summarized

the different views. The existence of multiple burrs, which, following Teilhard, I may call "pseudo burrs," led authors to consider this as evidence that portions of the "horn" were deciduous, and that they were analogous to the Cervid pedicle and antler. The failure to find antlers shed at the burrs militated against this, though Frick quotes with approval a suggestion of Matthew (1924, p. 203) that the antlers were shed in mountainous regions, and that the animals only resorted to the alluvial flats, where their remains are now discovered, when the antlers were in velvet. Matthew, however, dismissed the suggestion as unlikely, and his final conclusion was that the "horns" were not deciduous, while an affinity with *Antilocapra*, in support of which he adduced numerous arguments, rendered it probable that they were covered with a horn-sheath as in the living species. The presence of vascular grooves on the surface of the "horn" would appear to imply that it was covered either by skin or keratin, whether periodically renewed or not, but the opinion now most generally held is that no part of the "horn" as found was ever shed. The more fragile nature and multiplicity of the "pseudo burrs" indicates that they are not homologous to the true burrs of the Cervidæ. What then can have been their purpose? It is certain that the horn-sheath must have originated from a primitive stage in which the horn-core was covered merely by skin and hair. May the "pseudo burr" then be related in some way to the formation of keratin and have served as a primitive method of making the horn-sheath secure? This would be all the more necessary since in *Antilocapra* the growth of the new horn-sheath proceeds from the tip downwards, and is almost complete before the old sheath is cast off. The "pseudo burr" would naturally often remain as the sole indication of the horn-sheath to which it was formerly attached, and a fresh "pseudo burr" would be formed at the base of the new horn-sheath. This would account for the occurrence of several "pseudo burrs," their persistence being dependent on whether fortuitous external contacts succeeded in detaching them. Frick's observation (1937, p. 281) that the younger specimens of *Meryceros* show no burrs, these being confined to the aged individuals,

is noteworthy, as possibly indicating that the juvenile "horns" of *Meryceros* were covered with skin and hair only and that the "pseudo burrs" are a feature connected with the initial stage of keratinization. In the Antilocapridæ, on the contrary, corneous sheaths arose simultaneously with the horn-core itself, and the mechanism involved by the transformation of hair to keratin had time to become perfected, so that "pseudo burrs" were unnecessary and atrophied. Frick (1937, p. 281) also mentions a *Meryceros* "horn" in which "the anterior prongs were definitely worn, the wear having taken place in life when that portion at least of the 'horns' was unprotected by covering. A similar condition would be impossible in the case of *Antilocapra*, where although the sheath is deciduous the core is never uncovered." This equally suggests that in this stage of development the Merycodontine "horn" was covered merely by skin.

We are further led to ask whether it is possible to postulate that the "horns" were covered with a corneous sheath even in certain Miocene Bovidæ, such as *Eotragus*. At any rate, is it not probable that those of the Lower Miocene ancestors of Bovidæ and Merycodontidæ alike were merely skin-covered?

There is one other question to which it would be as well to try to find an answer. Did the deciduous horn-sheath of the Merycodontidæ precede the permanent one of the Bovidæ or *vice versa*? Bohlin, in a personal communication to me, expresses the opinion that the horn-sheaths in both must have been deciduous in the first instance until the requisite adjustment was made between the growth of horn-sheath and horn-core. On *prima facie* grounds I think that the reverse is more likely. Cope (1877, p. 348) stressed the fact that the mere fact of the horn-sheath being branched necessitated its replacement, since otherwise forward growth could not take place. An additional argument in favour of this view is provided by the probable existence of a branching horn-sheath, which must apparently, *ipso facto*, have been deciduous, on a Bovid lineage quite unrelated to *Antilocapra*. This is the Bovid genus *Tragocerus*, of which Bohlin (1935) described horn-cores which have a strong morphological resemblance to those of the living genus

Antilocapra, inferring that, like the latter, the horn-sheaths must have been forked. Pilgrim (1937, pp. 781, 797; 1939, pp. 243, 247) independently noted the existence of this type of horn-core, not only in *Tragocerus*, but also in the earlier *Miotragocerus* and the Chinji (Tortonian) genus *Sivaceros*, and concurred in Bohlin's view that the horn-sheaths of these were at any rate occasionally forked. These are the only known instances of the structure among the Bovidae. There can be no question of the relationship of the two lineages, since the Antilocapridae are structurally related to the Aegodont Bovidae, especially to the Caprinae, while the Tragocerinae are Boodont Bovidae whose relation to the Boselaphinae is no less certain. One can hardly avoid the conclusion (1) that the forking of the horn-sheath was independently acquired in both cases; and (2) that the forking and replacement of the sheath were correlated, and that neither occurred in the ancestors of the Tragocerinae. Even such a Merycodont as *Osbornoceras*, with twisted but unbranched "horns," might conceivably not have shed its horn-sheath, if such a structure existed in that genus.

SUMMARY.

In conclusion, the variant types of fossil "horn" which have been considered in this paper seem to lend some support to the deductions which are to be drawn from the histological study of the living types: that the skin-covered "horn" was the most primitive and that the nearest approximation to it is to be seen in the Lagomerycid and Giraffid "horn." From this original type it is easy to surmise that the deciduous antlered "horn" of the Cervidae arose, though the intermediate stage is as yet unknown. By the keratinization of the epidermis the Bovid horn-sheath may equally have had a similar origin, though the precise time when the change occurred cannot be ascertained from fossils, since the horn-core often provides no evidence as to whether its cover was of skin or keratin. The branching of the Bovoid horn led through mechanical exigencies to the periodical shedding of the horn-sheath as seen in *Antilocapra*, presumably in the extinct Antilocapridae and Merycodontidae, and also on the Tragocerine lineage of the Boselaphinae.

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XI.—*New Indian Curculionidæ (Col.)*

By SIR GUY A. K. MARSHALL, F.R.S.

THE types of the ten new species described below will be deposited in the British Museum.

Subfamily PRIONOMERINÆ.

Although not a single species of *Endæus* Schönh. has so far been described from the Indian subregion, the genus is probably just as well represented there as in Africa; for in addition to the eight species described here at least a dozen others are known to me, of which the material is inadequate for description.

Key to the Indian Species of *Endæus*.

- 1 (10). Head not constricted behind eyes.
- 2 (5). Elytra without pubescence, but with regular rows of conspicuous short, stout, pale setæ; without a row of erect setæ beyond the tooth on front femora.
- 3 (4). Setæ on elytra recumbent; eyes not projecting laterally beyond the temples; forehead distinctly narrower than base of rostrum *butea*, sp. n.
- 4 (3). Setæ on elytra erect; eyes much more convex, projecting beyond the temples, forehead very nearly as wide as base of rostrum.... *echinatus*, sp. n.
- 5 (2). Elytra with fine recumbent pubescence and very inconspicuous recumbent fine dark setæ; front femora with a row of erect setæ beyond the tooth.
- 6 (9). Derm. red-brown to yellowish brown; rostrum stout, much shorter than pronotum (3 : 4.5 or 5); elytra broadly ovate.

- 7 (8). Derm red-brown ; elytra with the sides sinuate behind the shoulders, a shallow common transverse sub-basal impression, a very obtuse subapical callus and an impression below it ; tooth on front femora not longer than width of tibia. *piger*, sp. n.
- 8 (7). Derm yellowish brown ; elytra not sinuate behind the shoulders, without any sub-basal impression or posterior callus ; tooth of front femora longer than the width of the part of the tibia adjoining it *gilvus*, sp. n.
- 9 (6). Derm black ; rostrum much more slender, as long as pronotum ; elytra narrowly ovate, not sinuate laterally behind the shoulders, without posterior calli ; tooth of front femora longer than width of tibia *ater*, sp. n.
- 10 (1). Head deeply constricted behind eyes ; elytra with recumbent pubescence and stiff conspicuous setæ.
- 11 (14). Setæ on elytra recumbent ; basal half of rostrum with rather sparse transverse or oblique setæ, and transversely convex in ♂.
- 12 (13). Rostrum moderately stout, only slightly curved, the carinæ feeble, the setæ broad and oblique *elusus*, sp. n.
- 13 (12). Rostrum much stouter, strongly curved, the carinæ sharp, the setæ much finer and transverse *strictus*, sp. n.
- 14 (11). Setæ on elytra erect or suberect ; basal half of rostrum in ♂ flat dorsally, with dense longitudinal setæ *ligatus*, sp. n.

Endæus butææ, sp. n.

♂♀. Derm testaceous yellow, pronotum normally darker, head and rostrum blackish to dark brown ; metasternum sometimes brownish.

Head opaque, with shallow separated punctures ; forehead more than half as wide as the rostrum, with coarse longitudinally confluent punctures and a few elongate scales ; eyes not projecting laterally beyond the temples. *Rostrum* similar in the two sexes, a little shorter than the pronotum (4 : 5), stout, slightly curved, with coarse confluent punctation throughout, and five low narrow carinæ on the basal half. *Antennæ* with the funicle widening distally, joint 2 shorter than 1, 4-6 transverse and contiguous. *Prothorax* transverse (5 : 6), rounded laterally, widest at a little behind the middle, with a shallow collar-like constriction at the apex, which is much narrower than the arcuate base ; dorsum finely aciculate, with shallow round separated punctures, each containing a strap-like recumbent seta directed obliquely backwards. *Elytra* broadly ovate, much wider at the

rounded shoulders than the prothorax, gently rounded laterally, widest at the middle, very broadly rounded behind, with the apices separately rounded, without any posterior calli or impressions; striae with deep punctures which scarcely diminish behind, the intervals flat, shiny, without pubescence, but each with a single regular row of recumbent strap-like yellowish setae. *Legs* with shallow punctation and sparse broad setae; front femora with a comparatively small tooth (not longer than the width of the tibia), without any fringe of setae beyond it, the tooth on the posterior pairs of nearly the same size; tibiae rather deeply sinuate at the base, the apical half parallel-sided and carinate beneath.

Length 2 mm., *breadth* 1 mm.

BIHAR: Namkum, 15 ♂♂, 18 ♀♀, on flowers of *Butea frondosa*, iii. 1939 (*P. M. Glover*—type). UNITED PROVINCES: Dehra Dun, Jhajra, 2 ♀♀, xi. 1910. S. INDIA: Coorg, Fraserpet, 5 ♀♀, vi.—vii. 1930.

Endæus echinatus, sp. n.

♂. Derm testaceous-yellow, head and rostrum red-brown.

Head coarsely and closely punctate throughout, with suberect setae; forehead nearly as wide as the rostrum; eyes convex, projecting beyond the temples. *Rostrum* shorter than the pronotum, stout, slightly curved, with confluent longitudinal punctation, the five narrow sinuous carinae on the basal half rather indistinct. *Antennae* as in *E. buteæ*. *Prothorax* nearly as long as broad, rounded laterally, widest behind the middle, not or very feebly constricted at the apex, which is much narrower than the arcuate base; dorsum shiny, not aciculate, with strong dense punctures, each containing a very short suberect spatulate seta. *Elytra* very broadly ovate, much wider at the rounded shoulders than the prothorax, almost parallel-sided in the basal half, very broadly rounded behind, separately rounded at the apex, leaving the pygidium broadly exposed (♂), without any posterior calli or impressions; the intervals bare and shiny, with a single regular row of stiff erect subtruncate setae (much narrower than those on *buteæ*) which arise from very minute granules. *Legs* finely rugulose, with sparse sub-recumbent setae; front femora with a sharp tooth which

does not project beyond the tibia when folded against it and without erect setæ, the tooth on the other femora of the same size ; anterior pairs of tibiæ bisinuate on the lower edge.

Length 2.5 mm., *breadth* 1.1 mm.

S. INDIA : Coimbatore. 3 ♂, xii. 1937.

Endæus piger, sp. n.

♂♀. Derm uniform red-brown, underside darker ; the antennæ, legs, and apex of rostrum flavescent.

Head with shallow confluent rugulose punctation and sparse pubescence ; forehead half as wide as the base of the rostrum, eyes not projecting laterally beyond the temples. *Rostrum* short, stout, not longer than the head, almost straight, wider beyond the antennæ, coarsely and closely punctate on the basal part in ♂, less so in ♀, the apical area almost impunctate. *Antennæ* with the funicle not widening distally, joint 2 about as long as 1, 5 and 6 moniliform and slightly longer than broad. *Prothorax* transverse (7 : 9), rounded laterally, widest a little behind the middle, very shallowly constricted at the apex, which is only a little narrower than the arcuate base ; dorsum finely rugulose, with small separated punctures and fairly close transverse pubescence. *Elytra* broadly ovate, much wider at the roundly rectangular shoulders than the prothorax, distinctly sinuate laterally behind the shoulders, then rather broadly rounded, widest behind the middle, obtusely acuminate behind, dehiscent at the apex, with a very obtuse subapical callus and a shallow impression below it, and a common shallow transverse impression at one-fifth from base ; striæ with deep close punctures which diminish slightly behind ; the intervals feebly convex, shiny, with rather thin pubescence which is usually less dense in a band across the top of the declivity, each interval with a single row of very inconspicuous fine dark subrecumbent setæ. *Legs* very finely rugulose, with sparse setæ ; front femora with the sharp tooth somewhat larger than on the other pairs, but not longer than the width of the tibia, and with stiff erect setæ beyond it ; tibiæ very shallowly sinuate at the base, the apical half parallel-sided and not carinate beneath.

Length 2.1–2.6 mm., *breadth* 1.0–1.2 mm.

S. INDIA : Kodaikanal, 1 ♂, 8 ♀♀ (*T. V. Campbell*).

Endæus ater, sp. n.

♂♀. Derm black above and below, with the scape, the last tarsal joint, and sometimes the base of the femora flavescent; the funicle and the apex of the rostrum red-brown.

Head rugosely punctate, with very sparse pubescence; forehead a little more than half as wide as the base of the rostrum, eyes scarcely projecting beyond the temples. *Rostrum* as long as the pronotum, moderately stout, distinctly curved, not dilated apically, strongly punctate laterally on the basal half, with a smooth dorsal stripe continued to the base in ♀, but punctate basally in ♂. *Antennæ* as in *E. piger*. *Prothorax* transverse (4:5), rounded laterally, widest at the middle, feebly constricted at the apex, the constriction not continued across the dorsum, the truncate base somewhat wider than the apex; dorsum rugosely punctate, with thin transverse pubescence. *Elytra* elongate-ovate, much broader at the rectangularly rounded shoulders than the prothorax, feebly rounded laterally, not sinuate behind the shoulders, widest behind the middle, obtusely acuminate behind, jointly rounded at the apex, without any subapical calli; the deep striæ with strong close punctures, which diminish behind; the intervals convex, shiny, with thin uniform dark pubescence and rows of very inconspicuous short dark fine recumbent setæ. *Legs* with the tooth on the front femora long and sharp, much larger than those on the other pairs and longer than the width of the tibia, with a row of erect setæ beyond it; front tibiæ shallowly sinuate on the basal half, the apical half slightly convex on the lower edge and feebly carinate, hind tibiæ not sinuate basally.

Length 2.3–2.5 mm., *breadth* 1.0–1.1 mm.

S. INDIA: Nilgiri Hills, 1 ♂, 1 ♀ (*T. V. Campbell*).

Endæus gilvus, sp. n.

♂♀. Derm yellowish to reddish brown, often with faint lighter or darker mottling.

Head with fine rugulose confluent punctation and sparse pubescence; forehead half as wide as the base of the rostrum; eyes convex, but scarcely projecting beyond the temples. *Rostrum* stout, much shorter than the

pronotum (3 : 5), slightly curved, gradually widening from base to apex, rugosely punctate from base to antennæ in ♂, impunctate in the middle in ♀, the apical area with distinct separated punctures. *Antennæ* with the funicle not widening distally, joint 2 slightly shorter than 1, 5 and 6 longer than broad. *Prothorax* transverse (5 : 6), rounded laterally, widest a little behind the middle, shallowly constricted at the apex, which is much narrower than the subtruncate base; dorsum with rugose punctation and thin transverse pubescence. *Elytra* rather broadly ovate, much wider at the roundly rectangular shoulders than the prothorax, moderately rounded laterally, not sinuate behind the shoulders, widest at the middle, without posterior calli, jointly rounded at the apex, with a very feeble transverse impression at one-fifth from the base; dorsum rather more convex than usual, both longitudinally and transversely, the deep striæ with small separated punctures; the intervals slightly convex, with very short pale pubescence which does not conceal the derm, and each with a somewhat irregular row of fine dark subrecumbent setae, which are usually more numerous on intervals 1-3. *Legs* with the femoral tooth rather large and triangular, that on the front pair much longer than the width of the tibiæ and with a row of setae beyond it; front tibiæ rather shallowly sinuate at the base, the lower edge of the apical half feebly arcuate and carinate. *Abdomen* of ♂ with the pygidium visible from beneath.

Length 2.5-3.1 mm., *breadth* 1.4-1.6 mm.

S. INDIA : Nilgiri Hills, 13 ♂♂, 5 ♀♀ (*T. V. Campbell, H. L. Andrewes, A. K. Weld Downing*); Chikkaballapura, 1 ♂ (*T. V. Campbell*—type).

Endæus elisus, sp. n.

♂♀. Derm yellowish brown, with thin brassy pubescence and stout recumbent setae.

Head deeply constricted behind the eyes, the forehead about one-third as wide as the rostrum, with a row of erect setae on each side. *Rostrum* as long as (♂) or longer than the pronotum (♀), moderately stout, parallel-sided, gently curved, with longitudinally confluent punctures and five feeble carinæ, the basal half strongly convex transversely, with broad oblique setae. *Antennæ* inserted

at one-third from the apex of the rostrum in ♂, slightly, nearer the middle in ♀; funicle not widening distally, joint 2 much shorter than 1. *Prothorax* transverse (4:5), rounded laterally, widest well behind the middle, shallowly constricted at the apex, which is much narrower than the subtruncate base; dorsum with punctures rather larger than those near the base of the elytra, the intervals narrow and shiny, with sparse pubescence and transverse setæ. *Elytra* rather broadly ovate, slightly narrower in ♀, feebly rounded laterally, not sinuate behind the rounded shoulders, widest a little behind the middle, jointly rounded at the apex, without posterior calli, moderately convex longitudinally, highest at the middle; the striæ with small deep close punctures, which diminish greatly behind, the intervals smooth and shiny, with sparse brassy pubescence and with a regular row of stout, short, pale recumbent setæ. *Legs* with the front femora much thicker than the others, with a larger triangular tooth, which is longer than the width of the tibia, and a row of erect setæ beyond it; front tibiæ moderately sinuate on the basal half.

Length 2.0 mm., breadth 0.9–1.0 mm.

S. INDIA : North Salem, Ayur, 5 ♂♂, 3 ♀♀, vii.–viii. 1930.

Endæus strictus, sp. n.

♂. Extremely close to the preceding species, the description of which applies to it, except in the following particulars:—*Rostrum* much thicker, more strongly curved, the carinæ more raised and sharp, the setæ narrower, more sparse and transverse. *Prothorax* slightly longer proportionately, with rather smaller punctures, which are not larger than those near the base of the elytra.

Length 2.3 mm., breadth 1.1 mm.

S. INDIA : North Salem, Ayur, 2 ♂♂, vii.–viii. 1930.

Endæus ligatus, sp. n.

♂♀. Another close ally of *E. elisus*, differing as follows:—*Head* with the forehead at least half as wide as the base of the rostrum. *Rostrum* of ♂ shorter than the prothorax (4:5), slightly curved, with the dorsal area quite flat on the basal half and covered with dense longitudinal scale-like setae, so that the sculpture is entirely hidden; rostrum of ♀ much stouter, longer than the prothorax

(6:5), strongly curved, transversely convex dorsally on the basal half, with rather sparser and narrower setæ, so that the carinæ are visible. *Antennæ* of ♂ inserted at two-fifths from the apex of the rostrum, the scape well exceeding the anterior margin of the eye, as usual; antennæ of ♀ inserted at the middle, the scape only just reaching the front margin of the eye. *Prothorax* with the brassy pubescence more evident and the setæ erect or suberect. *Elytra* with the rather longer setæ more sharply pointed and erect or suberect.

Length 2.3–2.5 mm., breadth 1.0–1.1 mm.

S. INDIA : Coorg, Frazerpet, 3 ♂♂, 2 ♀♀, vi. 1930, i. 1931 (type). MYSORE : Bangalore, 1 ♂, viii. 1919.

The sexual differences in the rostrum and antennæ are very abnormal, and it is possible that they may belong to different species, but until the receipt of further material I prefer to regard them provisionally as conspecific.

Subfamily TRACHODINÆ.

Acicnemis bauhinia, sp. n.

♂♀. Derm red-brown, with dense scaling and very broad truncate erect setæ; head pale brown; prothorax pale brown, with a sublateral whitish stripe, which has an indefinite external projection at about the middle and curves inwards towards the apex, the median portion of the disk usually dark brown on the basal half; scutellum fulvous; elytra light brown, the suture fulvous, with an elongate black patch at the base and a shorter one on the declivity, a few whitish scales along the basal margin from interval 3 to the shoulders, a very irregular sparse macular white band at one-fourth from the base between striæ 2 and 6, an anteriorly biarcuate broad white band behind the middle, interrupted on the suture, its front margin fairly sharply defined, its hind margin irregular, and a variable oblong blackish patch on intervals 3–5 between the two white bands.

Head with an erect tuft of four broad spatulate setæ on each side of the forehead. *Rostrum* with dense scaling and numerous erect scale-like setæ as far as the antennæ. *Antennæ* red-brown, with the apex of the scape blackish; scape not reaching the eye, with a fringe of suberect scales on its anterior edge; funicle with joint 1 a little

longer than 2, 3-6 slightly longer than broad, subequal and clavate. 7 rather longer; club ovate, not pedunculate, pubescent throughout. *Prothorax* as long as broad, gently rounded laterally, widest at a little behind the middle, very shallowly constricted at the apex, the post-ocular lobes short, with a dense fringe of scales; dorsum strongly convex longitudinally, highest at the middle, the base much lower than the apex, set with close deep punctures having high narrow walls; the broadly clavate erect setae unevenly distributed, the scales concave. *Elytra* oblong-ovate, parallel-sided from the prominent rectangular shoulders to beyond the middle, separately rounded at the apex; the striae with deep separated punctures which rapidly diminish behind; intervals broader than the striae, of equal height, the alternate ones with a regular row of very broad erect spatulate setae, which are black or yellowish. *Legs* with dense grey scaling, the femora with a basal and a median black patch, the tibiae with a median one; hind femora not exceeding the elytra, the triangular tooth larger than that on the other pairs, with a straight distal edge; front tibiae curved dorsally, with a sharp angulation on the lower edge beyond the middle.

Length 3.5-4.2 mm., *breadth* 1.5-1.7 mm.

UNITED PROVINCES: Dehra Dun, 2 ♂♂, 2 ♀♀, from *Bauhinia* ? *vahlii*, x. 1924 (type), 1 ♂, 1 ♀, from *Dalbergia sissoo*, ix. 1933; Dehra Dun, Jhajra, 4 ♂♂, 2 ♀♀, ix. 1929. BENGAL: Kurseong, Bagdogra, Dahura, 1 ♀, from *Michelia champaca*, viii. 1935, Bagdogra Range, 1 ♂, x. 1935 (all *J. C. M. Gardner*).

A distinct species, coming nearest to *A. praeambulans* Faust, from Belgaum, which has the elytra with intervals 2, 4, 6, 8 entirely fulvous and the suture black from the base to the top of the declivity except for a white patch in the middle, without any postmedian white band; rostrum longer, more slender and much more finely punctate.

Subfamily CRYPTORRHYNCHINÆ.

Syrotelus arcifer, sp. n.

♂♀. Derm dull black, with dense scaling; head with fawn-coloured scaling and a large blackish patch anteriorly, which has a V-shaped excision on its hind margin,

and with a broad pale longitudinal stripe on the vertex ; prothorax with a pale semicircular arc, having its ends close to the basal angles and its summit in the middle, where it joins a pale median stripe running from the middle to the apex ; elytra with light brown scaling and very variable black patches, of which the most constant and conspicuous is a rounded sub-basal patch between intervals 3 and 6, and often immediately behind this a broad oblique pale band from behind the shoulder to interval 3 ; underside with subcontiguous broad pale scales.

Head with the rugose sculpture entirely concealed, the forehead as wide as the narrowest part of the rostrum, with a large median fovea. *Rostrum* of ♂ moderately stout, curved, sinuate laterally, wider at the base than at the apex, rugosely punctate and sparsely squamose on the basal half, the apical half shiny and impunctate ; rostrum of ♀ similar, but with the punctation confined to the basal third or two-fifths. *Prothorax* transverse, almost parallel-sided from base to middle, then narrowing in a broad curve to the collar-like apical constriction ; dorsum longitudinally convex behind the constriction, with numerous small shiny granules showing through the dense scaling on the darker parts only ; scales ovate or lanceolate, mostly not overlapping, without a fovea. *Scutellum* strongly convex longitudinally, compressed laterally, bare in the middle, with a patch of yellowish scales on each side. *Elytra* ovate, rounded laterally, widest at about one-fifth from base, jointly and sharply acuminate behind, but the apical process very short ; the dorsal outline convex, highest at about the middle, steeply declivous behind ; the striæ broad and deep, with large deep punctures, which are only partly hidden by scaling and diminish behind, each containing a scale ; the intervals strongly costate, each with a sometimes irregular row of numerous small shiny granules bearing a short recumbent scale-like seta, the granules more or less duplicated on interval 3 ; scales small and only partly overlapping. *Legs* with dense grey scaling, the femora with the apex and a band close to it blackish ; femora not at all clavate, with a small tooth on the front pair, those on the other pairs obsolescent ; all the tibiæ quite straight on the lower edge.

Length 6–8 mm., *breadth* 3–4 mm.

BENGAL: Kurseong, Bagdogra Range, 2 ♂♂, 4 ♀♀, xii. 1936 (*C. F. C. Beeson*).

Nearly allied to *S. umbrosus* Roel., from Japan, which differs in having the head brown with two whitish spots; prothorax with only a few smaller granules, and the scales large and round, with a median fovea; scutellum simply convex, with dense white scales; striæ on elytra very shallow, the punctures entirely hidden by the very large, closely overlapping scales, the granules on the intervals much fewer.

Subfamily ZYGOPINÆ.

PEMPHERULUS, gen. nov.

The cotton-stem weevil of India was described by Faust (1898) as *Pempheres affinis*, but its position in that genus has always seemed dubious. I therefore pointed out to Dr. K. M. Heller several characters distinguishing the species from *Pempheres*, and asked him to examine the type, as well as that of *P. pleurostigma* Fst. (also described from South India). He agreed that these two species should be removed into a new genus, which he asked me to describe.

The genus can be distinguished from its allies by the following key:—

- | | |
|---|--------------------------------|
| 1 (6). Scutellum large, subquadrate, as wide as both the sutural intervals together. | |
| 2 (3). Anterior tibiæ of both sexes with a small lamellate projection on the inner edge. | <i>Dædania</i> Pasc. |
| 3 (2). Anterior tibiæ normal. | |
| 4 (5). First two joints of funicle equal; hind femora exceeding elytra; prosternum of ♂ armed with spines | <i>Chirozetes</i> Pasc. |
| 5 (4). Joint 2 of funicle longer than 1; hind femora not exceeding elytra; prosternum of ♂ without spines | <i>Pempheres</i> Pasc. |
| 6 (1). Scutellum small or elongate, not wider than a single sutural interval. | |
| 7 (8). Hind femora much exceeding the elytra, with a large triangular tooth, much larger than that on front femora; two basal joints of funicle equal; scutellum elongate, densely squamose throughout. | <i>Phylaitis</i> Pasc. |
| 8 (7). Hind femora not or but slightly exceeding the elytra, with a small sharp tooth, not much larger than that on front pair; joint 1 of funicle somewhat longer than 2; scutellum small, round, entirely bare or bare laterally. | <i>Pempherulus</i> , gen. nov. |

In addition to the characters given in the key, *Phylaitis* differs in having the eyes larger and the head much more convex in both directions; and *Pempheres* lacks the normal depression at the base of the suture, interval 1 being on a level with 2.

The genotype of *Pempherulus* is *Pempheres affinis* Fst., and with it must be associated *Pempheres pleurostigma* Fst., *Phylaitis confusa* Pasc., *Ph. caffer* Fhs., *Ph. lineata* Pasc., *Ph. pterospermi* Mshl., and *Ph. grewiae* Mshl.

The males in this genus have spines on the prosternum, but in *P. affinis* these appear to be normally much reduced and are often entirely absent.

It may be noted that *Phylaitis scutellaris* Mshl. must be transferred to *Chirozetes*.

XII.—*Diptères Dolichopodides de la région Indo-australienne. Espèces et localités nouvelles.* Par l'Abbé O. PARENT (Ambleteuse, Pas de Calais).

I. *APHROSYLINÆ*.

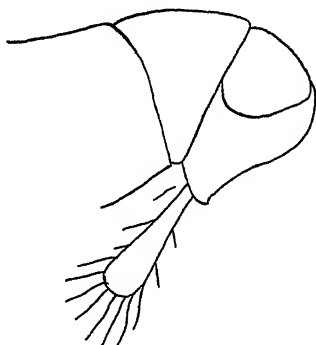
Genre *CYMATOPUS* Kertész.

Cymatopus simplex, sp. n. (Figs. 1 et 2.)

Mâle.—Front à poudré gris blanc; une paire de robustes chètes orbitaires à mi-chemin entre vertex et antennes. Face grise. Cils post-oculaires inférieurs pâles. Antennes noires, courtes, l'article 3 ovulaire, pas plus long que large; soie apicale. Mésonotum terne, noir au fond, à poudré brun; 4 d.c.; pas d'acrosticales, 2 scutellaires, 1 prothoracique noir. Abdomen noir; lamelles hypopygiales externes (fig. 1) jaunâtres, en ruban étroit, arrondi à l'apex, à soies pâles, courtes. Hanches noires, i. à pilosité blanche; sur le bord externe une série verticale de petites épines noires; iii. avec un chète externe noir. Trochanters et pattes bruns à légère teinte rougeâtre. Fémur i., face ventrale, à l'extrême base, avec 2-3 chètes épines contigus, presque aussi longs que le travers. Pattes sans particularités de structure ni de vestiture, la pilosité grossière et rigide. Ailes

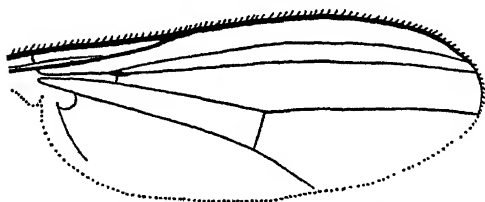
(fig. 2) grises, à nervures noires, 3 et 4 nettement convergentes. Balanciers jaunes. Cuillerons à cils pâles. Long. 2 mm.

Fig. 1.



Cymatopus simplex, sp. n., ♂, hypopyge.

Fig. 2.



Cymatopus simplex, sp. n., ♂, aile.

Femelle un peu plus corpulente, semblable au mâle.

Burpengary (S. Queensland) (Dr. T. L. Bancroft).
Type au British Museum.

II. *CAMPSICNEMINÆ*.

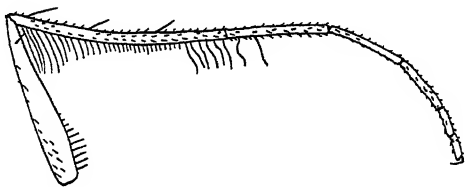
Genre *PYCSYMNUS* Frey.

Pycsymnus maculatus Par. (Fig. 3.)

Chez le mâle le fémur ii. (fig. 3) présente, sur les 2/5 basilaires, une série d'une dizaine de soies rigides, dont

les médianes plus développées sont aussi longues que le travers.

Fig. 3.



Pycsymnus maculatus Par., ♂, tarse ii.

III. *CHRYSOSOMATINÆ*.

Genre *CHRYSOSOMA* Guérin.

1. *Chrysosoma amplipenne*, sp. n. (Figs. 4 et 5.)

Mâle.—Front vert métallique, très brillant : pas de soie orbitaire. Face renflée, à poudré blanc, l'épistome vert, le clypeus jaunâtre, la largeur moyenne égale aux $\frac{2}{3}$ d'un travers d'œil. Palpes, trompe et favoris jaunes. Antennes jaune clair ; soies de l'article 2 très courtes, 3 en forme de lancette au moins 3 fois aussi long que large, noir à l'extrême apex. Soie apicale, noire, simple, longue comme l'abdomen. Mésonotum vert métallique très brillant, étroitement jaune à l'avant et sur les cotés. Flancs jaunes avec quelques taches grises. Ecusson vert métallique avec 2 chètes. Métaphragme vert métallique. Abdomen jaune clair, les segments 1-4 avec, au bord postérieur, une tache triangulaire vert brillant, en pointe vers l'avant ; les autres segments manquent ; pilosité courte, une seule série transversale de chètes. Hanches et pattes jaune clair. Hanches à vestiture claire ; i., face antérieure, ligne externe, avec une série de 8 épines jaunes ; iii. avec plusieurs soies. Patte i. : fémur, face ventrale, une série dense et régulière de poils rigides, pâles, longs comme le travers. Tibia inerme ; face postérieure, sur la moitié apicale, une ciliation pâle, semblable à celle du fémur, mais plus courte. Tarse (fig. 4) 1 fois $\frac{1}{2}$ aussi long que le tibia, ornementé ; pro-tarse sensiblement égal au reste, cilié à la face postérieure ; 2 échancré ventralement après le milieu. Patte ii. : fémur,

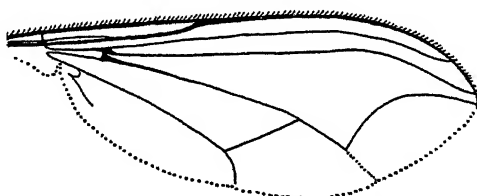
face ventrale, à cils rigides, pâles, de longueur décroissante vers l'apex, les basilaires longs comme le travers. Tibia face antérieure, une série de 8-9 chètes fins formant une ciliation irrégulière. Tarse 1 fois $\frac{1}{3}$ aussi long que le

Fig. 4.

*Chrysosoma amplipenne*, sp. n., ♂, tarse i.

tibia. Patte ii.: fémur, face ventrale, avec quelques cils blancs. Tibia manque. Ailes (fig. 5) remarquablement larges, à nervures brun jaune, la 4^e longitudinale épaissie à la racine. Balanciers jaunes à capitule brun.

Fig. 5.

*Chrysosoma amplipenne*, sp. n., ♂, aile.

Cuillerons jaunes avec une tache noire et des cils clairs. Long. 5.5 mm.

Femelle inconnue.

Thekkaid, Periyar Dam, Travancore. Type au British Museum.

2. *Chrysosoma cupido* Walk. Chine : Canton.

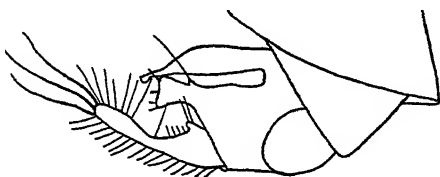
3. *Chrysosoma dilectum* Par. N. Guinea.

4. *Chrysosoma hilare*, sp. n. (Figs. 6-8.)

Mâle.—Front vert métallique brillant; une soie orbitaire minuscule, jaune. Face verte, à léger satiné

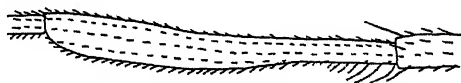
jaune, renflée, sa largeur moyenne égale aux $2/3$ d'un travers d'œil. Palpes et trompe jaunes. Favis pâles. Antennes jaune rouge, article 2 à chète dorsal au moins aussi long que l'article 3, celui-ci conique, guère plus long que large. Soie apicale noire, longue comme thorax et écusson réunis. Mésonotum vert métallique peu brillant, 3 acrosticales grandes, 2 d.c. à l'arrière, 2 scutellaires. Abdomen vert métallique, une étroite bande noir mat sur les incisions ; une seule série transverse de chètes.

Fig. 6.

*Chrysosoma hilare*, sp. n., ♂, hypopyge.

Hypopyge (fig. 6) et ses appendices noirs, les externes à ciliation noire. Hanches i. jaune clair, à vestiture claire, une rangée de 4 soies jaunes sur la moitié apicale ; ii. et iii. noires, iii. avec 2 soies jaunes. Pattes jaunes, les derniers articles des tarsi à peine brunis. Fémurs pratiquement nus à la face ventrale. Patte i. : tibia, face dorsale, 2 chètes dont le 2^e vers le milieu ; face

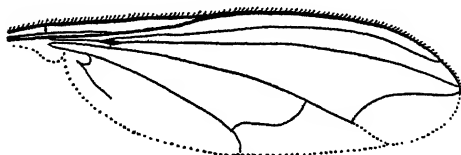
Fig. 7.

*Chrysosoma hilare*, sp. n., ♂, protarse i.

ventrale, ligne postérieure, 4 longues soies fines la dernière préapicale arquée. Tarse un peu plus long que le tibia ; protarse (fig. 7) plus long que le reste, aplati à la face ventrale, et élargi sur les $3/4$ apicaux ; une ciliation noire au bord postérieur de la partie étroite, une peluche pâle à la semelle de la partie élargie. Patte ii. : tibia, face dorsale, 3 chètes antérieurs, 2 postérieurs, un ventral.

Tarse un peu plus long que le tibia, protarse plus long que le reste. Patte iii. : tarse un peu plus court que le tibia ;

Fig. 8.



Chrysosoma hilare, sp. n., ♂, aile.

protarse sensiblement égal au reste. Ailes (fig. 8) sans tache, légèrement teintées de rouille, à nervures brun jaune. Balanciers jaunes. Cuillerons à cils jaunes. Long. 7.5 mm.

Femelle inconnue.

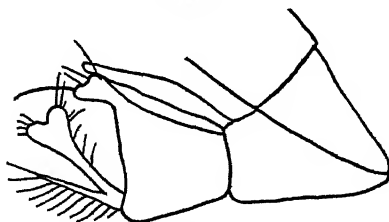
Travancore. Type au British Museum.

5. *Chrysosoma humile* Beck. S. Formosa, Takao (*H. Sauter*).

6. *Chrysosoma impudens*, sp. n. (Figs. 9 et 10.)

Mâle.—Front vert métallique, à léger givré jaune ; au coin postérieur, une touffe de soies folles jaunes. Face vert bronzé, à léger satiné gris, à côtés convergents, de

Fig. 9.

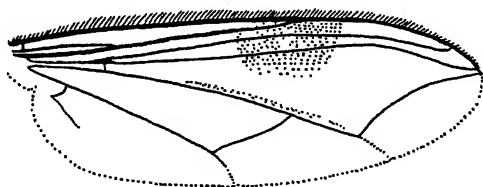


Chrysosoma impudens, ♂, sp. n., hypopyge.

largeur moyenne égale aux 2/3 d'un travers d'œil. Trompe noire. Favis pâles. Antennes noir brunâtre ; soies de l'article 2 deux fois aussi longues que 3, celui-ci 1 fois 1/2 aussi long que large ; soie simple, un peu plus longue

que tête et thorax réunis. Mésonotum vert métallique, avec 3 fascies longitudinales pourpre cuivreux, 4 acrosticales robustes, 2 d.c. précédées de soies minuscules; 2 scutellaires. Abdomen vert métallique, à poudré blanc de neige remarquable même sur le disque; une large bande noir mat sur les incisions, une seule série transverse de soies; pilosité noire, longue. Hypopyge (fig. 9) noir à pilosité longue; appendices noirs. Hanches noires à vestiture blanche, i. avec soies apicales jaunes. Trochanters noirs. Pattes noires, le fémur i. rouge à l'apex; son tibia rouge sur la moitié basilaire. Patte i.: fémur, face ventrale sur la moitié basilaire, une série de 4 longues soies pâles, les 2 basilaires surtout développées, longues au moins comme la demi-longueur à peine croissante vers l'apex; face ventrale, après le milieu, une très longue soie noire. Tarse 1 fois $1/4$ aussi long que le tibia;

Fig. 10.

*Chrysosoma impudens*, sp. n., ♂, aile.

protarse plus long que le reste, orné de 2 longs chètes au bord dorsal. Patte ii.: fémur, face ventrale, une pilosité blanche, érigée, longue comme le travers. Tibia, face dorsale, 3 longues soies; face ventrale, 2 chètes antérieurs longs, 1 postérieur plus court. Tarse plus long que le tibia; protarse au moins 1 fois $1/2$ aussi long que le reste. Patte iii.: fémur, face ventrale, une pilosité blanche, fine, rigide, au moins aussi longue que le travers. Tibia face dorsale, un chète antérieur robuste, au cinquième basilaire. Tarse: les 3 derniers articles manquent. Ailes (fig. 10) à fond blanc laiteux, une tache brune rectangulaire, mal délimitée, contre le bord antérieur, au niveau de l'embouchure de la 1^{re} longitudinale, intéressant les 3 premières longitudinales. Costa ciliée. Première longitudinale extraordinairement longue, ayant

son embouchure au delà de la transverse postérieure. Transverse apicale naissant à angle droit, formant arcature régulière. Transverse postérieure S-forme. Balanciers jaune brun. Cuillerons à cils jaunes. Long. 6-6.5 mm.

Femelle inconnue.

W. Sumatra, 6-12. xii. 08, Padang, Schoede S.G. Type au Muséum de Berlin.

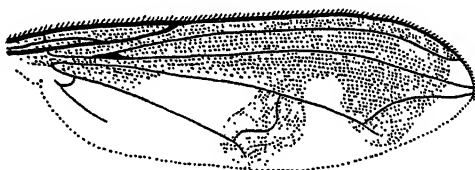
7. *Chrysosoma leucopogon* Wied. Formose.

8. *Chrysosoma Leveri* Par. Russell Is (*R. A. Lever.*)

9. *Chrysosoma lucigena* Walk. (Fig. 11.)

Femelle.—Front violet assez brillant. Face à satiné blanc, large comme les $\frac{2}{3}$ d'un travers d'œil. Antennes jaune rouille, l'article 2 à soies presque aussi longues que

Fig. 11.



Chrysosoma lucigena Walk., ♀, aile.

3, celui-ci 1 fois $\frac{1}{2}$ aussi long que large. Soie au moins aussi longue que l'abdomen. Mésonotum violacé encadré de vert. Abdomen violet brillant à bandes transversales noir mat. Hanches i. jaunes; face externe, moitié basilaire, avec une série de 3 longues soies noires; les soies apicales noires; ii. et iii. noires. Trochanter i. jaune, ii. et iii. noir franc. Fémurs jaunes, noir brun sur la moitié apicale; tibias jaune rouge, noircis à l'apex; iii. plus largement; tarses jaune brun, i. presque entièrement, ii. à partir de l'apex du protarse, iii. entièrement brun noir. Fémur i., face antérieure tout au long, une série de 6-7 longues soies noires; face ventrale, sur les $\frac{2}{3}$ basilaires, une série de 5 soies noires très longues. Tibia, face dorsale, une série de 4 soies noires, la première moins développée, les autres longues comme les $\frac{2}{3}$ de la longueur du tibia. Protarse presque 2 fois aussi long que

le reste ; face dorsale, avec, à la base, 2 chètes remarquables. Patte iii. : tibia nettement plus long que le tarse, protarse un peu plus long que le reste. Ailes (fig. 11) blanc laiteux au fond, une bande brune sur la moitié antérieure ; deux bandes transversales. Transverse postérieure fortement S-forme. Balanciers jaunes. Cuillerons à cils jaune brun. Long. 6 mm.

N. Guinea.

C'est la première fois que je vois la femelle de cette espèce, jusqu'ici non décrite.

10. *Chrysosoma maculipenne* Guérin. Nouvelle Guinée allemande.

11. *Chrysosoma melanochirum* Bezzi. Iles Fidji.

12. *Chrysosoma nigricinctum*, sp. n. (Figs. 12 et 13.)

Mâle.—Front vert métallique brillant, malgré un léger givré blanc ; au coin postérieur, un buisson de soies folles noires. Face verte au fond, à satiné blanc, de largeur moyenne égale au moins aux 2/3 d'un travers

Fig. 12.

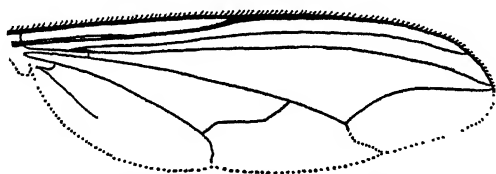


Chrysosoma nigricinctum, sp. n., ♂, hypopyge.

d'œil. Palpes et trompe noirs. Favoris blancs. Antennes noires ; article 2 à chète dorsal un peu plus long que l'article 3 ; celui-ci conique, un peu plus long que large ; soie apicale, simple, un peu plus longue que tête, thorax et écusson réunis. Mésonotum vert plutôt mat, 4 acrosticales longues, 2 d.c. postérieures, 2 scutellaires. Abdomen vert, une bande transversale noir mat sur les incisions, une seule série transverse de chètes, pilosité longue. Hypopyge (fig. 12) et ses appendices noirs, les externes à ciliation blanche. Hanches noires, à vestiture blanche. Trochanters et pattes noirs, le tibia ii. rougeâtre

sur sa moitié apicale, son protarse entièrement et franchement jaune. Patte i. : fémur, face ventrale, 5 longues soies pâles. Tibia, face dorsale, 5 soies chétiformes de longueur croissante vers l'apex ; face ventrale, 2 soies chétiformes après le milieu. Tarse 1 fois $1/2$ aussi long que le tibia, protarse un peu plus court que le tibia, très légèrement épaissi sur le tiers basilaire, aplati ventralement et muni d'une peluche ; un chète robuste, face dorsale, avant le milieu. Patte ii. : fémur, face ventrale, une villosité blanche, fine, un peu plus longue que le travers. Tibia face dorsale, 4 chètes antérieurs, un chète ventral au cinquième basilaire. Tarse 1 fois $1/2$ aussi long que le tibia, protarse plus long que le reste, cilié à la face antérieure ainsi que les autres articles ; 4 et 5, face dorsale, à crinière blanche. Patte iii., fémur face

Fig. 13.

*Chrysosoma nigricinctum*, sp. n., ♂, aile.

ventrale avec même pilosité que ii. Tibia avec une callosité. Protarse plus long que l'article suivant, les autres articles manquent. Ailes (fig. 13) un peu enfumées, plus intensément au bord antérieur. Transverse apicale dessinant une arcature régulière. Transverse postérieure fortement S-forme. Balanciers noirs. Cuillerons à cils blancs. Long. 7 mm.

Femelle inconnue.

Solomon Is., Guadalcanal, Lunga : 26. iii. 35 (*R. A. Lever*). Type au British Museum.

Très voisin de *leucopogon* Wied, s'en distingue comme suit :

«Trois soies acrosticales, 4 d.c. Abdomen sans bandes transversales noir mat. Appendices hypopygiaux externes une fois fourchus. Tibias jaune rouge. Patte i. : tibia, face dorsale, 3, face ventrale 1 soie chétiforme ; protarse avec 2 chètes dorsaux. Tarse ii., article 4 blanc, à crinière blanche..... *leucopogon* [Wied.]

Quatre soies acrosticales, 2 d.c. à l'arrière. Abdomen à bandes transversales noir mat. Appendices hypopygiaux externes 2 fois fourchus. Tibias brun noir. Patte i.: tibia, face dorsale 5, face ventrale 2 soies chétiformes; protarse avec un seul chète dorsal. Tarse ii.: article 4 noir, les articles 4 et 5 à crinière blanche. [sp. n. *nigricinctum*,

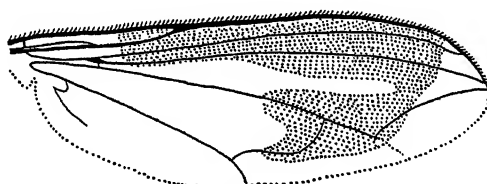
13. *Chrysosoma Pagdeni* Par. Solomon Is. (R. A. Lever).

14. *Chrysosoma prolongatum* Par. Toyenmongai, bei Tainan, Formosa.

15. *Chrysosoma protervum*, sp. n. (Fig. 14.)

Si voisin de *C. vanum* (vide infra) qu'une description complète me paraît inutile. Je signalerai seulement les différences. Brides de la capsule hypopygiale sans longues soies fines à l'apex. Tibia iii. jaune. Protarse ii. brun, iii. noir. Protarse i. sensiblement égal au reste. Tibia ii., face dorsale, 3 chètes postérieurs. Aile (fig. 14)

Fig. 14.



Chrysosoma protervum, sp. n., ♂, aile.

avec une bande costale brune, débutant avant l'embouchure de la 1^{re} longitudinale, la tache quadrangulaire qui suit mal délimitée. Balanciers à capitule jaune clair. Cils des cuillerons clairs.

Pirmed, 3400 ft., Travancore. Type au British Museum.

16. *Chrysosoma pulcherrimum* Beck. Tekkadi, Periyar Dam, Travancore.

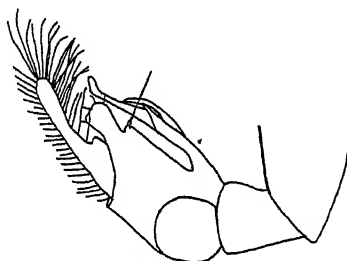
17. *Chrysosoma Salomonis* Par. Solomon Is., Tulagi (R. A. Lever).

18. *Chrysosoma trisignatum*, sp. n. (Figs. 15 et 16.)

Mâle.—Front à fond vert métallique, transparaissant sous une pruine blanche; une soie orbitaire folle, noire.

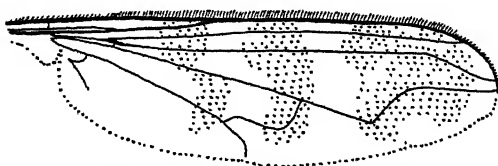
Face renflée, à épais satiné blanc, de largeur moyenne égale aux $\frac{3}{4}$ d'un travers d'œil. Palpes et trompe bruns. Favoris clairs. Antennes noires, article 2 à chètes très courts, 3 conique un peu plus long que large. Soie apicale simple, longue comme l'abdomen. Mésonotum vert métallique brillant, 3 acrosticales longues; 2 d.c.

Fig. 15.

*Chrysosoma trisignatum*, ♂, sp. n., hypopyge.

à l'arrière; 2 scutellaires. Abdomen vert métallique brillant, moniliforme, sans bandes transversales noir mat, pilosité courte, une seule série transverse de chètes. Hypopyge (fig. 15), ses appendices et leur ciliation, noirs. Hanches i. jaunes, à pilosité blanche, 3 soies apicales

Fig. 16.

*Chrysosoma trisignatum*, sp. n., ♂, aile.

noires; ii. et iii. noires, iii. à soies folles. Trochanters et pattes jaune clair; fémur iii. noir sur le quart apical, tibias ii. et iii. confusément noirs à l'apex, iii. avec une fascie noire, face antérieure, sur le 2^e quart. Tarses noirs à partir de l'apex du protarse. Tous les fémurs, face ventrale, à soies fines, pâles, rigides, un peu plus longues que le travers. Patte i.: tibia, face

dorsale, ligne postérieure, une courte ciliation arquée, qui se prolonge sur le tarse entier et, sur la même ligne, 6 soies fines plus longues que le travers, dont 4 dans la moitié basilaire. Tarse 1 fois $\frac{2}{3}$ aussi long que le tibia ; protarse presque égal au tibia. Patte ii. : tibia et tarse à pilosité courte, érigée, en écouvillon ; tarse un peu plus long que le tibia, protarse plus long que le reste. Patte iii. : tarse sensiblement égal au tibia, protarse égal au reste. Aile (fig. 16) à fond blanc, 3 bandes brunes transversales, non confluentes à l'avant. Costa ciliée. Balanciers jaunes. Cuillerons noirs à cils noirs. Long. 5.5 mm.

Femelle semblable au mâle, cependant le fémur iii. entièrement jaune ; tibia ii. et son tarse à pilosité couchée ; une soie orbitaire robuste ; face non renflée, plus étroite.

Pirmed, 3400 ft. Travancore. Type au British Museum.

19. *Chrysosoma ungulatum*, sp. n. (Figs. 17-19.)

Mâle.—Front vert brillant, une soie orbitaire minuscule. Face vert au fond, à satiné blanc. Favoris pâles. Antennes noires, article 2 à soies dorsales égales à l'article 3,

Fig. 17.

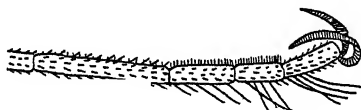


Chrysosoma ungulatum, sp. n., ♂, hypopyge.

celui-ci un peu plus large que long, triangulaire ; soie longue comme le mésonotum seul. Mésonotum vert brillant, 5 d.c. dont seules la première et les deux dernières bien développées, 3 acrosticales grandes, 2 scutellaires. Abdomen brillant, vert, varié de rouge cuivreux, une

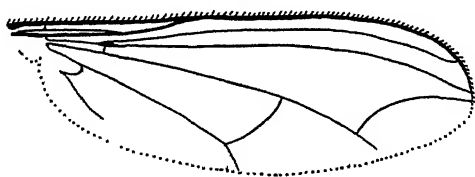
étroite bande noir mat sur les incisions ; occupant le 1^{er} segment et la base du (fig. 17) segment 2, une bande transversale de givré blanc de neige, une seule série transverse de chètes. Hypopyge et ses appendices noirs. Hanche i. jaune à vestiture exclusivement blanche ; ii. et iii. noires ; iii. avec 2 soies externes blanches. Trochanters jaunes. Pattes jaunes, l'extrême apex du

Fig. 18.

*Chrysosoma unguatum*, sp. n., ♂, tarse i.

fémur iii. et de tous les tibias brun ; les tarses entièrement noirs. Fémurs sans pilosité remarquable. Tibias pratiquement inermes, cependant ii. avec un chète dorsal bien développé près de la racine. Tarse i. (fig. 18) : articles. 4 et 5 avec crinière dorsale ; griffes hypertrophiées. Tarse ii. : protarse 1 fois 1/3 aussi long que le reste. Tarse iii. plus court que le tibia, protarse de peu mais nettement plus long que le reste. Ailes (fig. 19) grisâtres

Fig. 19.

*Chrysosoma unguatum*, sp. n., ♂, aile.

à nervures noires. Balanciers jaunes. Cuillerons à cils . . . ? Long. 4.5 mm.

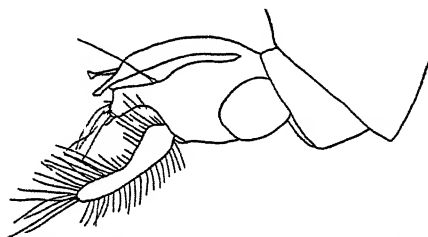
Femelle semblable au mâle, 4 d.c., pas de bande blanche à la base de l'abdomen ; hanche i. à vestiture exclusivement blanche ; apex du fémur iii. et des tibias brun, les tarses noirs seulement à partir de l'apex du protarse. Cils des cuillerons noirs.

I. Principe, W. Africa. Type au British Museum.

19. *Chrysosoma vanum*, sp. n. (Figs. 20 et 21.)

Mâle.—Front vert métallique brillant ; une soie orbitaire folle, minuscule, noire. Face bombée, couverte d'un épais satiné blanc, de largeur moyenne égale aux $\frac{2}{3}$ d'un travers d'œil. Trompe et palpes jaunes, ces derniers avec deux soies noires. Favoris blancs. Antennes jaune clair ; chètes de l'article 2 un peu plus longs que 3, celui-ci conique, un peu plus long que large ; soie apicale, longue comme thorax et écusson réunis. Mésonotum vert métallique peu brillant, 3 acrosticales longues, 2 d.c. à l'arrière, 2 scutellaires. Abdomen vert doré ; une large bande noir mat à la base des segments ; pilosité courte ; une seule série transverse de chètes. Hypopyge (fig. 20) ses appendices et leur ciliation noirs ;

Fig. 20.

*Chrysosoma vanum*, ♂, sp. n., hypopyge.

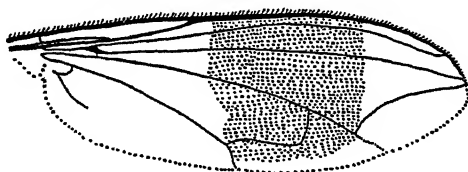
brides de la capsule, à l'apex, avec de longues soies noires, fines. Hanche i. jaune, à vestiture jaune, face antérieure, bord externe, moitié apicale, 4 longues soies robustes ; ii. et iii. noires, iii. une robuste soie jaune. Trochanters et pattes jaune clair ; tarse ii. noir à partir de l'apex du protarse ; iii. à partir du milieu du protarse. Tibia iii. jaune blanc. Fémurs pratiquement glabres à la face ventrale. Patte i. : tibia, face dorsale, 2 chètes postérieurs, 1 antérieur ; face ventrale, ligne postérieure, occupant le tiers médian, 3 soies fines, longues 1 fois $\frac{1}{2}$ comme le travers ; peu avant l'apex, 2 autres soies de même longueur. Tarse un peu plus long que le tibia, protarse plus long que le reste, cilié au bord postérieur, sur le cinquième basilaire ; sur les $\frac{3}{5}$ apicaux aplati ventralement et élargi au bord postérieur, avec peluche à la

semelle. Patte ii. : tibia, face dorsale, 4 chètes antérieurs, 1 postérieur près de la base, 2 ventraux ; tarse un peu plus long que le tibia ; protarse plus long que le reste. Patte iii. : tarse plus court que le tibia, protarse presque égal au reste. Ailes (fig. 21) à fond blanc ; une large bande transversale noire, rectangulaire, allant d'un bord à l'autre et de l'embouchure de la 1^{re} longitudinale à la furca. Balanciers à capitule jaune brun. Cuillerons à cils noirs. Long. 8 mm.

Femelle semblable au mâle ; cependant une soie orbitaire robuste ; tibia iii. jaune, tache de l'aile presque obsolète. 5 d.c.

Top Slip Camp, Nelliampathi Hills, S. India. Thek-kadi, Periyar Dam, Travancore. Tenmalai Travancore.

Fig. 21.

*Chrysosoma vanum*, sp. n., ♂, aile.

Burliyar 3000 ft. Coonoor Ghant, S. India. Type au British Museum.

Remarque. Cette espèce ressemble beaucoup à *stragulum* Beck. mais s'en sépare tout au moins par l'élargissement du protarse i. que Becker ne mentionne pas et qui n'aurait pu lui échapper.

20. *Chrysosoma vittatum* Wied. W. Sumatra, Bandar Buat, bei Padang. Bolampatti Vall. Coimbatore Distr., S. India.

Genre CONDYLOSTYLUS Bigot.

1. *Condylostylus fenestratus* Wulp. Toyenmongai bei Tainan, Formose. Coonoor, 6000 ft., S. India.

2. *Condylostylus latipennis*, sp. n. (Figs. 22-24.)

Mâle.—Front violacé brillant malgré un léger givré gris jaune ; une soie orbitaire robuste, accompagnée

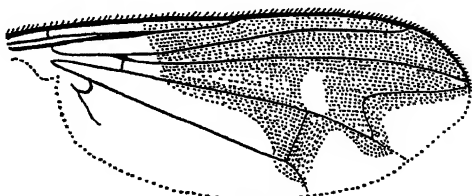
de soies folles pâles, formant série et arquées au bout. Face verte au fond, à épais satiné blanc, à côtés divergents, de largeur moyenne égale aux $\frac{2}{5}$ d'un travers d'oeil. Trompe jaune brun. Favoris pâles. Antennes noir brun, l'article 2 à soies courtes, 3 pas plus long que large; soie subapicale simple, longue comme le thorax.

Fig. 22.

*Condylostylus latipennis*, sp. n., ♂, hypopyge.

Mésonotum vert brillant, vert sur le disque, violacé sur le pourtour; 2 acrosticales grandes, 4 d.c. Ecusson violet, 4 chètes. Abdomen vert métallique, varié de violet, une seule série transverse de chètes, mal distincts de la pilosité qui est noire; dernier tergite bordé d'un peigne de

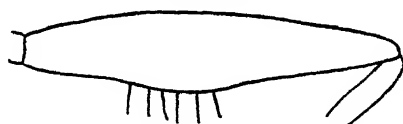
Fig. 23.

*Condylostylus latipennis*, sp. n., ♂, aile.

chètes rigides et épais. Hypopyge (fig. 22) et ses appendices noirs. Hanches noires, à pilosité pâle, i. à soies apicales noires iii. une soie externe noire. Trochanter i. jaune, ii. et iii. brun noir. Fémurs noirs, i. et ii. jaunes sur le tiers apical, iii. plus étroitement. Tibias jaune clair, iii. noir à l'extrême apex. Tarses i. et ii. jaunes, noirs à partir de l'apex du protarse, iii. entièrement noir

franc. Tous les fémurs, face ventrale, à pilosité blanche, délicate et rigide, longue comme le travers. Tibias sans chètes remarquables. Tarse i. un peu plus long que le tibia, protarse un peu plus long que le reste. Protarse iii. un peu plus court que le reste. Ailes (fig. 23) à fond laiteux, une tache brune occupant la moitié antérieure de l'aile, sur les $\frac{2}{3}$ apicaux, avec une tache fenêtrée; transverse apicale naissant à angle aigu, puis coudée à angle droit. Transverse postérieure droite. Balanciers jaunes. Cuillerons à cils noirs. Long. 5 mm.

Fig. 24.

*Condylostylus latipennis*, sp. n., ♀, fémur i.

Femelle.—Hanche i. jaune, montrant une série de spinules noires au bord interne; une série verticale de 3 soies chétiformes sur la moitié apicale de la face antérieure. Trochanters jaunes. Fémurs et tibias jaunes, les tarses i. et ii. jaunes, noirs à partir de l'apex du protarse, le tarse iii. entièrement noir profond. Fémur i. (fig. 24) face ventrale, avec une série de 6 épines fines, rapprochées, occupant le milieu.

Chine: Insel Hainan, Canton. Type au Muséum de Berlin.

3. *Condylostylus scopulosus* Par. Tekkadi, Periyar Dam, Travancore, Pirmed, 3400 ft., Travancore.
4. *Condylostylus striatipennis* Beck. S. Formosa, Kosempo.
5. *Condylostylus terminalis* Beck. Toyenmongai, bei Tainan Formosa.

Genre MEGISTOSTYLUS Big.

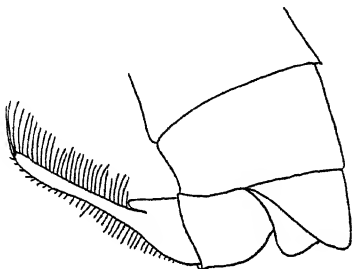
Megistostylus longisetosus Fab. Guadalcanal, Lunga (R. A. Lever).

Genre MESORHAGA Schiner.

Mesorhaga argentifacies, sp. n. (Figs. 25 et 26.)

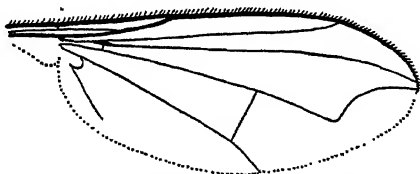
Mâle.—Front et face à satiné blanc argent. Front étroit. Face à côtés parallèles, large comme le tiers d'un travers d'œil. Palpes noirs. Tromperougeâtre. Favis pâles. Antennes noires, l'article 3 triangulaire arrondi,

Fig. 25.

*Mesorhaga argentifacies*, sp. n., hypopyge.

pas plus long que large. Soie dorsale, longue comme la hauteur de la tête. Mésonotum vert sombre, varié de violet assez brillant, 5 d.c. 2-3 acrosticales grandes, 2 scutellaires. Flancs cendrés. Abdomen vert, à vestiture noire, les soies marginales postérieures bien développées.

Fig. 26.

*Mesorhaga argentifacies*, sp. n., ♂, aile.

pées. Hypopyge (fig. 25) noir, petit, à appendices externes styliformes, noirs, à ciliation noire. Hanches noires plus ou moins rougeâtres, i. à vestiture noire, iii. avec un robuste chète externe noir. Trochanters brun rouge. Pattes jaunes, fémur i. bruni face dorsale, sur la

moitié basilaire, ii. et iii. noirs, jaunes sur le cinquième apical. Tarse i. brun à partir de l'apex du protarse, iii. entièrement. Patte i., fémur, face ventrale, deux séries divergentes de soies noires fines, la première de la série antérieure tranchant sur les autres par sa longueur, 2 fois égale au travers. Tibia, face dorsale, 2 chètes antérieurs, dans la moitié basilaire; 2 chètes postérieurs. Patte ii.: fémur, 1 préapical, face ventrale, moitié basilaire, quelques longues soies noires, fines, dont la basilaire très longue, une autre au milieu longue comme 2 fois le travers. Tibia face dorsale, 1 chète postérieur au milieu, précédé de 2 chétules; 3 antérieurs; face ventrale, 1 antérieur. Patte iii.: fémur, un préapical; face ventrale, une série de longues soies fines noires. Protarse sensiblement égal à l'article suivant, légèrement plus court. Ailes (fig. 26) teintées de brun, à nervures brun noir. Balanciers jaune pâle. Cuillerons noirs à cils noirs. Long. 4.5 mm.

Femelle inconnue.

Siam: Bulsit Besar. (*H. C. Robinson & N. Annandale*).
Type au British Museum.

Genre *SCIOPUS* Zeller.

1. *Sciopus filitarsis* Par. Solomon Is., Guadalcanal, Lunga (*R. A. Lever*) Décrit de la péninsule malaise.
2. *Sciopus occultus* Par. Solomon Is., Tulagi, 8. xi. 35 (*R. A. Lever*).
3. *Sciopus rdctus* [sic] Wied. S. Formosa, Takao, Sauter.
4. *Sciopus turbidus* Beck. S. Formosa, Takao, Sauter.

IV. *DIAPHORINÆ*.

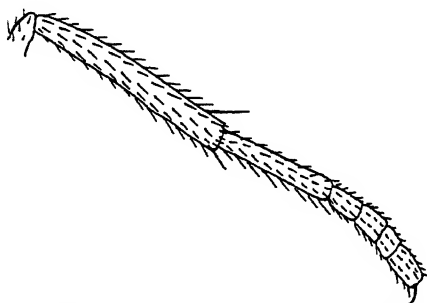
Genre *CHRYSOTUS* Meig.

Chrysotus divergens, sp. n. (Figs. 27 et 28.)

Femelle.—Front noir bronzé, peu brillant. Face noire à poudré gris blanc, moins large que le front, de largeur moyenne égale à $\frac{1}{4}$ de travers d'œil. Palpes et trompe noirs. Cils postoculaires inférieurs noirs. Antennes noires, soie courte. Mésonotum bronzé doré, brillant; de même l'écusson et l'abdomen. Hanches noires, à vestiture noire. Trochanters et fémurs noirs, tibia i.

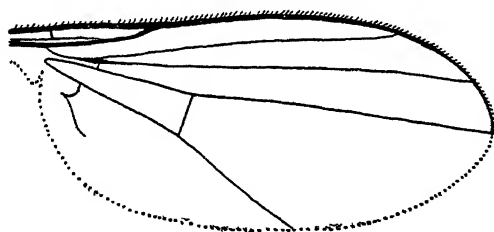
jaune, ii. et iii. noirs. Tarses jaunes, seuls les derniers articles brun noir. Patte i. : tibia (fig. 27) inerme ; tarse plus long que le tibia i., les 4 derniers articles très courts. Patte ii. : tibia, un chète dorsal antérieur.

Fig. 27.

*Chrysotus divergens*, sp. n., ♀, tibia et tarse i.

Protarse iii. plus long que l'article suivant. Ailes (fig. 28) : nervures 3 et 4 nettement divergentes. Balanciers noirs. Cuillerons à cils pâles. Long. 1.5 mm.

Fig. 28.

*Chrysotus divergens*, sp. n., ♀, aile.

Mâle inconnu.

Solomon Is., San Cristobal, Kira Kira, 8. v. 34 (*R. A. Lever*). Type au British Museum.

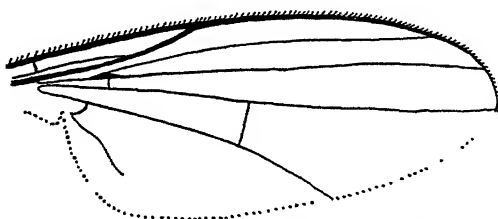
Genre DIAPHORUS Meig.

1. *Diaphorus basicinctus*, sp. n. (Fig. 29.)

Femelle.—Front et face de même largeur ; face à poudré gris blanc. Palpes et trompe noirs. Favoris blancs.

Antennes noires, l'article 3 semi-circulaire, rougeâtre à certaine incidence. Mésonotum noir au fond, 2 séries d'acrosticales, 5 d.c. 1 chète prothoracique noir. Abdomen noir, le segment 2 jaune sur la moitié basilaire. Hanches noires à vestiture noire. iii. avec un chète externe noir. Trochanters jaunes. Fémurs noirs, i. jaune sur les 2/3 apicaux, ii. sur le tiers apical. Tibias jaunes, iii. noir sur

Fig. 29.

*Diaphorus basicinctus*, sp. n., ♀, aile.

le tiers apical. Tarses i. et ii. jaunes, les derniers articles brunis, iii. entièrement noir. Tibia ii. : un chète ventral. Tarse iii. égal au tibia, le protarse égal à l'article 2. Ailes (fig. 29) enfumées. Balanciers jaunes. Cuillerons jaunes à cils noirs. Long. 4 mm.

Mâle inconnu.

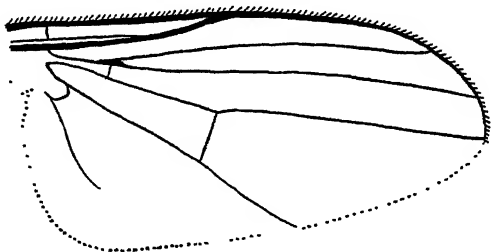
Solomon Is., Tulagi, 27. ii. 36 (*R. A. Lever*). Type au British Museum.

2. *Diaphorus lividus*, sp. n. (Fig. 30.)

Mâle.—Yeux contigus. Face noire, plus haute que large. Favoris noirs. Antennes noires, l'article 3 semi-circulaire, plus large que long ; soie à peine pubescente. Mésonotum vert sombre, peu brillant, pas d'acrosticales, 5 d.c. Abdomen vert sombre assez brillant ; macrochètes anaux peu développées. Hanches noires, i. à vestiture noire, iii. avec un chète externe noir. Trochanters brun noir. Fémurs noirs, jaunes à l'extrême apex ; tibias jaune clair ; tarses de même couleur, seuls les derniers articles légèrement brunis. Patte i. : tarse i. fois 1/3 aussi long que le tibia ; pelotes hypertrophiées ; pas de griffes. Patte ii. : tibia sans chète ventral ; pelotes normales ; des griffes. Ailes (fig. 30) de la forme

ordinaire au genre, brunies ; nervures noires. Balanciers brun noir. Cuillerons à cils noirs. Long. 2 mm.

Fig. 30.



Diaphorus lividus, ♂, sp. n., aile.

Femelle inconnue.

Formosa : Taihorin, (*H. Sauter*). Type au Muséum de Berlin.

3. *Diaphorus ochripes* Beck. S. Formosa, Takao (*H. Sauter*).

4. *Diaphorus wonosobensis* Meij. Toyenmongai, bei Tainan, Formosa (*Rolle*).

Les fémurs i. sont entièrement jaunes. A noter, si c'est bien l'espèce de Meijere, que seules les pelotes i. sont hypertrophiées et sans griffes.

V. *DOLICHOPODINÆ*.

Genre *DOLICHOPUS* Latr.

1. *Dolichopus angustinervis* Beck. Mittel China, Nankin.
2. *Dolichopus zickzack* Wied. Salatuga, Siam, Bulsit Besar (*A. C. Robinson & N. Annandale*).

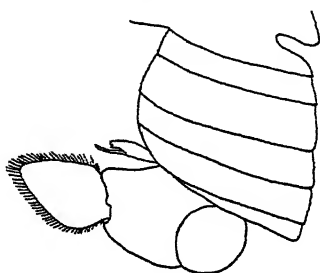
Genre *HERCOSTOMUS* Lw.

1. *Hercostomus blandulus* Par. Toyenmongai, bei Tainan, Formosa,
2. *Hercostomus breviventris*, sp. n. (Figs. 31-33.)

Mâle.—Front et face à épais poudré gris blanc. Front étroit. Face rétrécie en son milieu, sa plus faible largeur

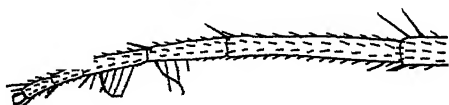
à peine égale à la moitié de celle du 3^e article antennaire. Palpes et trompe brun rouge. Cils postoculaires inférieurs noirs. Antennes noires, article 3 un peu plus large que long; soie pubescente, insérée au tiers apical. Mésonotum assez brillant, vert varié de bronzé doré. Abdomen remarquablement court, bronzé cuivreux, à pruine gris blanc sur les flancs. Hypopyge (fig. 31) noir, relativement

Fig. 31.

*Hercostomus breviventris*, ♂, sp. n., hypopyge.

gros; lamelles externes noires, à cils noirs, étui du pénis rouge. Hanches jaune rouge, à vestiture noire. Trochanters et pattes jaune rouge; tibia iii. noir sur le quart apical; aux tarses i. et ii. les 3 derniers articles noirs, au moins à la face dorsale, le tarse iii. entièrement noir. Patte i.: tibia, face dorsale, 3 chètes antérieurs, 3 postérieurs; pas de soie apico-ventrale; tarse égal au tibia.

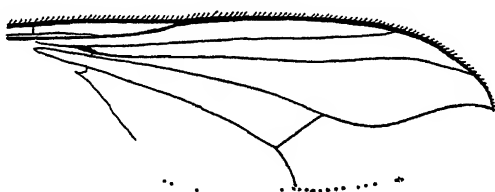
Fig. 32.

*Hercostomus breviventris*, sp. n., ♂, hypopyge.

Patte ii.: fémur, un chète préapical. Tibia, face dorsale, 4 chètes antérieurs 4 postérieurs; face ventrale, une série de 4 chètes robustes. Tarse (fig. 32) à peine plus long que le tibia, les articles 2 et 3 aplatis ventralement et un peu élargis, chacun avec, au bord postérieur, une ciliation clairsemée, et une soie ondulée plus longue. Patte iii.: fémur,

un chète préapical. Tibia, face dorsale, 4 chètes antérieurs, 4 postérieurs; face ventrale, une série de chètes faibles; face postérieure une brosse de poils noirs, de longueur croissante vers l'apex. Tarse long comme le tibia, le protarse de peu, mais nettement plus court que l'article suivant, muni d'un chète remarquable à la semelle, avant le milieu. Ailes (fig. 33): nervures 3 et 4 fortement convergentes; 4 sinueuse. Transverse postérieure très oblique, plus longue que la section apicale de la 5^e. Balanciers jaunes. Cuillerons jaunes à cils noirs. Long. 5 mm.

Fig. 33.

*Hercostomus breviventris*, sp. n., ♂, aile.

Femelle inconnue.

Bolampatti, Valley, Coimbatore Dist., S. India. Type au British Museum.

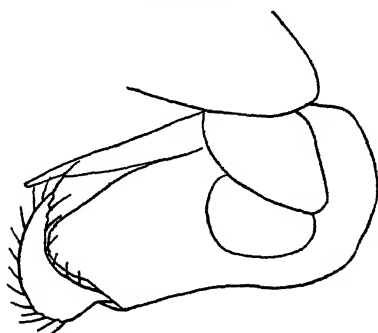
Remarque.—Cette forme me paraît faire transition au genre *Tachytrechus* dont elle présente la nervation et l'appareil génital. Elle s'en écarte pourtant par la face qui n'atteint pas le niveau inférieur des yeux et par l'unique chète préapical aux fémurs ii. et iii. Elle s'apparente par ailleurs par certains caractères au genre *Paraclius*.

3. *Hercostomus rollei*, sp. n. (Figs. 34 et 35.)

Mâle.—Front cuivreux. Face à satiné gris blanc, jaune au fond, large comme un demi-travers d'œil. Palpes et trompe jaune brun. Cils postoculaires inférieurs noirs. Antennes jaunes, l'article 3 un peu plus long que large, triangulaire, pointu à l'apex; soie pubescente. Corps vert sombre. Hypopyge (fig. 34) brun, gros, aussi long que l'abdomen; lamelles externes brunes, jaunâtres par transparence, en forme de croissant de lune.

Hanches jaunes, à vestiture noire. Trochanters et pattes jaunes. les derniers articles du tarse iii. à peine assombris. Patte i. : tibia, face dorsale, 2 chètes postérieurs, 1 antérieur suivi d'une serration de chétules ; pas de soie

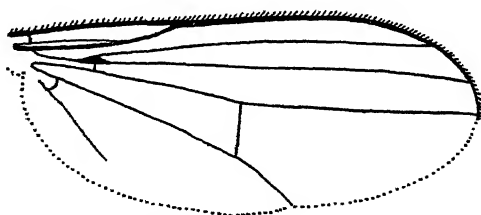
Fig. 34.



Hercostomus rollei, sp. n., ♂, hypopyge.

apico-ventrale. Patte ii. : manquent. Patte iii. : fémur, un chète préapical, protarse un peu plus court que l'article suivant. Ailes (fig. 35) hyalines à nervures noires ; 3 et 4 à peine convergentes, pratiquement

Fig. 35.



Hercostomus rollei, sp. n., ♂, aile.

parallèles. Balanciers jaunes. Cuillerons jaunes, à cils noirs. Long. 4 mm.

Femelle inconnue.

Toyenmongai bei Tainan, Formosa (*Rolle*), v. 1910. Type au Muséum de Berlin.

Genre METAPARACLIUS Beck.

Metaparaclius australiensis, sp. n. (Figs. 36-38.)

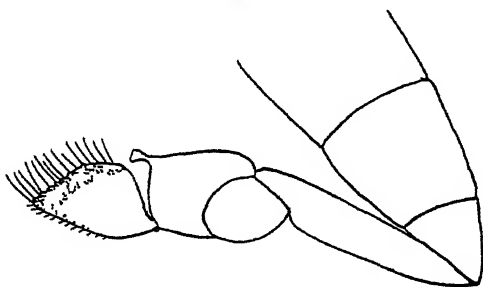
Mâle.—Front vert, terni par un délicat givré jaune. Face blanche, à côtés sensiblement parallèles, très étroite, large comme l'intervalle interocellaire. Palpes petits, jaunes. Soies postoculaires noires. Antennes (fig. 36, *a*) jaunes, l'article 3 assombri à l'apex ; article

Fig. 36.

Fig. 36 *a*.—*Metaparaclius australiensis*, sp. n., ♂, antenne.Fig. 36 *b*.—*Metaparaclius australiensis*, sp. n., palette antenneaire.

1 aussi long que les deux autres réunis, très épais, creusé en coupe, à la face dorsale velu seulement à l'apex ; article 2 court, 3 triangulaire, 1 fois 1/2 aussi long que large. Soie subapicale, d'un seul article, presque aussi longue que le corps, noire, terminée par une palette (fig. 36, *b*)

Fig. 37.

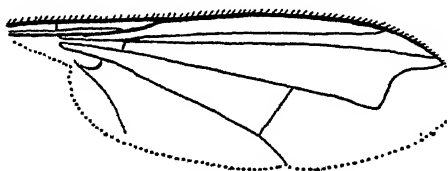
*Metaparaclius australiensis*, sp. n., ♂, hypopyge.

noire fendue à l'apex. Mésonotum peu brillant, vert sombre métallique, avec une fascie cuivreuse intéressant les deux séries d'acrosticales, 6 d.c. robustes, 2 scutellaires. Flancs noir verdâtre, 3 chètes prothoraciques, l'inférieur

seul bien développé. Abdomen long cylindrique, comprimé, à 6 segments dont les chètes marginaux sont bien développés, les segments verts à bord postérieurs noir purpurescent, à givré blanc argent sur les flancs.

cils jaunes, faibles et courts. Hanche i. jaune, à vestiture noire, ii. noires, iii. jaunes avec 2 chètes externes sur la même verticale. Trochanters et pattes jaunes, les derniers articles des tarses assombris par la vestiture. Patte i. : tibia, face dorsale, une série de 4 chètes robustes ; ligne ventropostérieure, une série de 4 chétules. Patte ii. : fémur, un chète préapical ; tibia, face dorsale, 3 antérieurs, 3 postérieurs, pas de ventral. Patte iii. : fémur, 1 préapical. Tibia, face dorsale, 2 séries de chètes robustes, un ventral précédé de chétules. Protarse très légèrement plus court que l'article suivant. Ailes (fig. 38)

Fig. 38.

*Metaparaclius australiensis*, sp. n., ♂, aile.

légèrement teintées de rouille, 4^e longitudinale section apicale, coudée après le milieu, et arquée convexe vers l'avant. Balanciers jaunes. Cuillerons jaunes à cils noirs. Long. 7 mm.

Femelle inconnue.

N. Queensland, Kuranda, 1100 ft., June 21–July 14 (R. E. Turner). Type au British Museum.

Remarque.—L'espèce présente est la deuxième connue du genre *Metaparaclius* créée par Becker. L'introduction de cette espèce appelle une rectification ou une adaptation des caractères génériques. Ici la soie antennaire est d'un seul article, alors que chez le génotype, elle présente, bien que très réduit, un article basilaire distinct. De même ici : 6 d.c. et seulement 2 scutellaires. Au fond les caractères fondamentaux du genre, communs aux

deux espèces qui le représentent sont, outre les caractères communs aux *Dolichopodinae* : article 1 des antennes long et plus ou moins épaissi, la soie antennaire subapicale, terminée par une palette, nervation du type des *Paraclius*.

Les deux espèces se distinguent comme suit :

Soies postoculaires pâles. Palette antennaire entière.	
Toutes les hanches noires. Fémurs en grande	
partie noirs, Cinq soies d.c. Tibia ii. avec	[Beck.
2 chètes ventraux.....	<i>subapicalis</i>
Soies postoculaires noires. Palette antennaire fendue.	
Hanches i. iii. jaunes. Six soies d.c. Tibia ii. sans	[n. sp.
chètes ventraux	<i>australiensis</i> ,

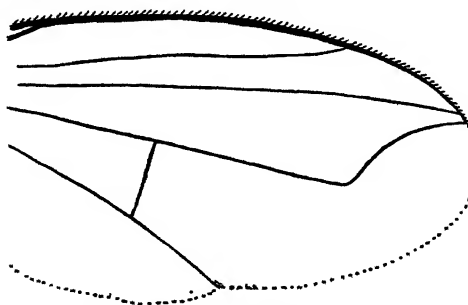
Genre PARACLIUS Big.

1. *Paraclius adligatus* Beck. Siam, Bulsit Besar (H. C. Robinson & N. Annendale).

2. *Paraclius albodivisus*, sp. n. (Fig. 39.)

Femelle.—Front vert bleu métallique, brillant, malgré un délicat givré blanc. Face à satiné blanc l, à côtés parallèles, large comme les $\frac{2}{5}$ d'un travers d'œil. Cils postoculaires inférieurs pâles. Antennes jaune rouge, l'article 3 noir sur les $\frac{3}{4}$ apicaux, à peine plus long que

Fig. 39.



Paraclius albodivisus, ♀, sp. n., aile.

large ; soie pratiquement glabre. Mésonotum vert bleu brillant, dans l'ensemble, mais noir purpurescent sur la déclivité antérieure ; une bande transversale noir pourpre d'une fossette notopleurale à l'autre, entre les deux bandes sombres une bande transversale à poudré blanc

de neige. Ecusson noir purpurescent sur les $\frac{2}{3}$ basilaires. Flancs verts à poudré blanc; un chète prothoracique noir. Abdomen brillant, dans l'ensemble cuivreux; une large bande noir purpurescent sur les incisions; une plage blanc argent sur les flancs. Hanches i. jaunes. ii. et iii. noires, toutes à vestiture noire. Trochanters et pattes jaunes, fémur iii. noir sur le quart apical, tarse ii. noirci à partir de l'apex du protarse, iii. entièrement noir. Patte i. : tibia face dorsale, 2 chètes postérieurs, 3 antérieurs. Patte ii. : fémur, un préapical; face ventrale une pilosité rude, noire, plus courte que le travers; tibia, face dorsale, 3 chètes antérieurs, 3 postérieurs, 1 seul ventral. Patte iii. : fémur, un chète préapical, tibia, un seul ventral; protarse un peu plus court que l'article suivant. Ailes (fig. 39) légèrement brunies; 4^e longitudinale à section apicale coudée au tiers apical et arquée convexe vers l'avant. Transverse postérieure égale aux $\frac{4}{5}$ de la section apicale de la 5^e. Balanciers jaunes. Cuillerons à longs cils noirs. Long. 5.5 mm.

Mâle inconnu.

Burpengary, S. Queensland (*Dr. T. L. Bancroft*).

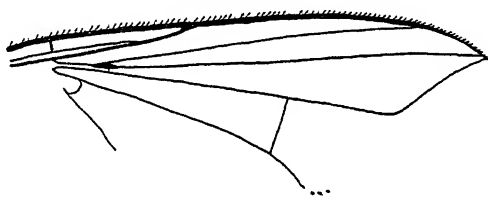
Remarque.—Très voisine de *P. Darwini* Par. cette espèce s'en distingue, au moins chez la femelle, par le tarse i. entièrement clair et le fémur iii. largement noir à l'apex.

3. *Paraclius scutopilosus*, sp. n. (Fig. 40.)

Femelle.—Front violacé brillant. Face à épais satiné gris blanc, s'élargissant un peu vers l'apex, de largeur moyenne égale aux $\frac{2}{5}$ d'un travers d'œil. Cils postoculaires inférieurs blancs. Antennes rouge brique, l'article 3 à peine teinté de brun au bord dorsal et au bord apical, moins long que large; soie pratiquement glabre. Mésonotum brillant, violacé pourpre sur le disque, vert bronzé sur le pourtour; de chaque côté, 2 taches blanc de neige, bien visibles à certaine incidence. Ecusson noir mat, velu, 2 chètes marginaux très robustes, 6 chètes accessoires remarquables, dont 4 internes et 2 externes. Abdomen noir bleuâtre, avec de chaque côté des segments, une tache blanc de neige, très réduite au segment 3; vestiture noire. Hanches i. jaunes, ii. et iii. noires, toutes à vestiture noire. Trochanters et pattes jaune rouge, un petit point noir à l'apex du fémur iii., tarses jaunes,

noirs à partir de l'apex du protarse, le tarse i. en réalité entièrement jaune, ne paraissant noir que par l'effet de la pilosité. Patte i. : tibia, face dorsale, 3 chètes proprement dorsaux, 4 antérieurs, 4 postérieurs; face postérieure 2 chètes robustes. Tarse aussi long que le tibia, le protarse égal au reste. Patte ii. : fémur, 3 chètes préapicaux le premier moins développé. Tibia, face dorsale, 4 chètes antérieurs, 4 postérieurs; face ventrale, 3 antérieurs, 1 postérieur. Tarse un peu plus long que le tibia, protarse plus court que le reste. Patte iii. : fémur, 2 préapicaux;

Fig. 40

*Paraclius scutopilosus*, sp. n., ♀, aile.

tibia, face dorsale, 4 antérieurs, 4 postérieurs, 1 proprement dorsale, au quart basilaire, protarse légèrement plus court que l'article suivant. Aile (fig. 40) légèrement ferrugineuse; section apicale de la 4^e brusquement coudée un peu avant son tiers apical, et arquée convexe vers l'avant. Balanciers jaunes. Cuillerons jaunes à cils noirs. Long. 5 mm.

Mâle inconnu.

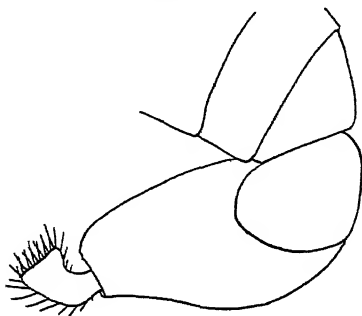
Solomon Is., Tulagi, 12. viii. 36 (*R. A. Lever*). Type au British Museum.

4. *Paraclius siamensis*, sp. n. (Figs. 41 et 42.)

Mâle.—Front et face ternis par un satiné blanc. Face large au plus d'un tiers de travers d'œil. Cils postoculaires pâles. Antennes noires, l'article i. rouge au bord ventral, 2 rougeâtre à la face interne, 3 guère plus long que large. Mésonotum vert noir assez brillant; un satiné blanc de neige visible d'avant en arrière sur la

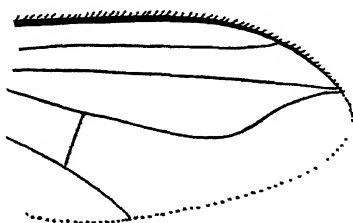
callosité humérale et la fossette notopleurale. Abdomen noir violacé. Hypopyge (fig. 41) noir, grand, non pédonculé; lamelles externes noires, rougeâtres à la racine, à cils grossiers, noirs. Hanches jaunes, à vestiture noire. Trochanters jaunes. Pattes jaunes, une étroite fascie

Fig. 41.

*Paraclius siamensis*, sp. n., ♂, hypopyge.

noire au bord dorsal du fémur iii.; tarses ii. et iii. à partir de l'apex du protarse paraissant bruns par l'effet de la pilosité. Patte i.: tibia, face dorsale, 3 chètes antérieurs, 2 postérieurs. Patte ii.: fémur, 2 préapicaux; tibia,

Fig. 42.

*Paraclius siamensis*, sp. n., ♂, aile.

face dorsale, 3 antérieurs, 3 postérieurs; face ventrale, un antérieur. Patte iii.: fémur un préapical; tibia, face ventrale, de simples chétules. Protarse de peu, mais nettement plus court que l'article suivant. Ailes

(fig. 42) teintées de rouille ; nervures noires. Balanciers jaunes. Cuillerons à cils noirs. Long. 3.5 mm.

Femelle inconnue.

Siam : Bulsit Besar (*H. C. Robinson and N. Annandale*).
Type au British Museum.

Genre PELASTONEURUS LW.

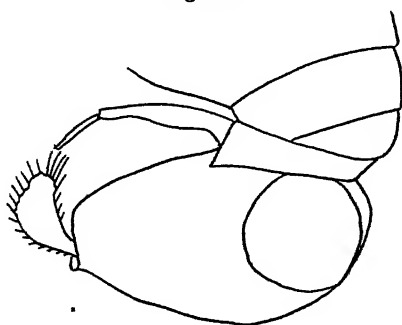
1. *Pelastoneurus crassinervis* Par. S. Formosa, Kosempo (*H. Sauter*).

Remarque.—Cette espèce est très voisine de *P. bifarius* Beck. décrit de la même localité. En particulier e, ll, a même nervation, même épaissement des nervures 23 e et 4 à la base, le même appareil génital, les deux mêmes taches circulaires noir mat sur les côtés du pronotum (ce que j'ai omis de signaler dans ma description). Cependant il n'y a au mésonotum qu'une strie médiane nette, non encadrée par des stries plus étroites, et du reste noir profond et non brun rouge à brun café. De plus le tibia ii. n'a pas 3 chètes dorsaux et un seul ventral mais 5 chètes dorsaux et 2 ventraux dont un antérieur.

2. *Pelastoneurus luteoscutatus*, sp. n. (Figs. 43 et 44.)

Mâle.—Front et face ternis par un satiné gris argent. Face large comme les 3/5 d'un travers d'œil. Cils post-

Fig. 43.

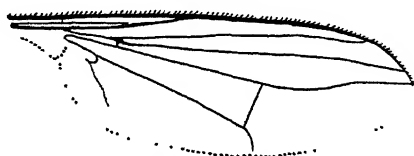


Pelastoneurus luteoscutatus, sp. n., hypopyge.

oculaires tous noirs. Antennes entièrement jaune rouge, l'article 3 pas plus long que large ; soie courtement

plumeuse. Mésonotum vert olive sur le disque, jaune rouge sur le pourtour, à poudré blanc ; une strie médiane noire débordant les soies acrosticales ; une autre plus large et moins délimitée, flquant extérieurement les d.c. Ecusson entièrement jaune. Flancs noirs à plaques bordées de jaune. Abdomen noir purpurescent. Hypopyge (fig. 43) noir, les lamelles externes noires, à ciliation jaune brun. Hanches i. et iii. jaunes, celle-ci avec un point noir à la base externe ; ii. noires. Patte i. jaune (ii. et iii. manquent) tibia, face dorsale, 3 antérieurs, 2 postérieurs, les derniers articles du tarse avec peluche à la semelle, à reflets blanc argent à l'article 5. Ailes

Fig. 44.

*Pelastoneurus luteoscutatus*, aile.

(fig. 44) teintées de rouille ; nervures jaunes. Balanciers jaunes. Cuillerons jaunes à cils noirs. Long. 6.5 mm.

Femelle inconnue.

Lower Ranges N. Khasi Hills, Assam, 1878 (*A. Chennel*).
Type au British Museum.

Genre POLYMEDON O. S.

Polymedon inopinatum Par. China, Tsha-jiu-san, 10. vii. 10
Melle, S.V.

Genre TACHYTRECHUS Walk.

Tachytrechus picticornis Big. = *salinarius* Beck. = *seychellensis* Lamb. Toyenmongzi, bei Tainan, Formosa.
Rille, v. 1910.

VI. HYDROPHORINÆ.

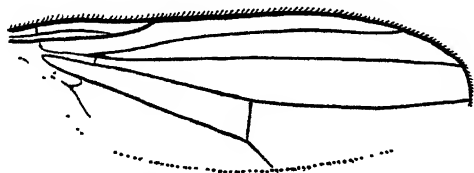
Genre THINOPHILUS Wahlb.

1. *Thinophilus æqualichætus*, sp. n. (Fig. 45.)

Mâle.—Front vert. Face verte large comme les 2/5 d'un travers d'œil. Palpes jaunes, à pilosité noire.

Favoris pâles. Antennes : article 1 noir (les autres manquent). Mésonotum vert, acrosticales absentes, 5 d.c. toutes également robustes, 2 scutellaires. Flancs verts. Abdomen vert. Hypopyge noir, à appendices externes bruns, triangulaires. Hanche i. jaune, ii. et iii. noires. Trochanters et pattes jaunes, les derniers articles des tarses à peine brunis ; chétosité peu remarquable. Fémurs ii. et iii. sans chètes préapicaux ni dorsaux. Protarse iii. égal à l'article suivant. Ailes (fig. 45) teintées de rouille, à nervures brunes, 3 et 4 nettement convergentes ; transverse postérieure au moins égale à la section apicale

Fig. 45.

*Thinophilus æqualichætus*, sp. n., ♂, aile.

de la 5^e. Balanciers jaunes. Cuillerons à cils clairs. Long. 1.75 mm.

Femelle semblable au mâle.

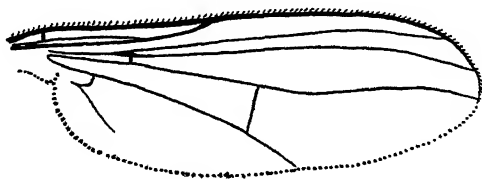
Iles Philippines, Luzon. Type au Muséum de Berlin.

2. *Thinophilus annulatus*, sp. n. (Fig. 46.)

Femelle.—Front vert sombre, à pailletis fauve. Face ternie par un poudré fauve, large comme les $\frac{3}{4}$ d'un travers d'œil. Palpes à poudré brun, et pilosité noire. Favoris jaunes. Antennes rouge brique, les articles bruns au côté dorsal, 3 sur la moitié dorsale. Mésonotum rouge cuivreux, terne ; une strie médiane verte sur l'emplacement des acrosticales absentes ; 8 d.c. bien développées, la première plus faible ; 2 scutellaires ; aux propleures 2 touffes de soies folles blanches. Abdomen vert brillant. Toutes les hanches noires, i. à pilosité blanche, iii. avec un chète externe blanc, fin. Trochanters et pattes jaune rougeâtre ; à tous les tarses l'extrémité des articles noire, ce qui leur donne un aspect annelé.

Patte i. : tibia face dorsale, 3 chètes antérieurs, 4 postérieurs. Patte ii. : fémur avec un préapical vrai. Patte iii. : fémur. un préapical vrai. 2-3 chètes préapicaux dorsaux. Tibia face dorsale, 5 antérieurs, 5 postérieurs. Protarse plus long que l'article suivant. Ailes (fig. 46) teintées de

Fig. 46.

*Thinophilus annulatus*, ♀, aile.

rouille ; nervures brun rouille. Balanciers jaunes. Cuillerons jaunes à cils pâles. Long. 5.5 mm.

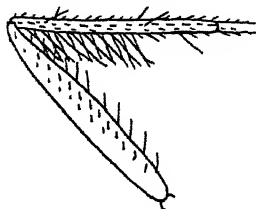
Mâle inconnu.

Queensland (*Dr. T. L. Bancroft*). Type au British Museum.

3. *Thinophilus hilaris*, sp. n. (Figs. 47 et 48.)

Mâle.—Front vert brillant un chète orbitaire bien développé. Face verte, large comme le 3^e article antennaire. Palpes jaunes à pilosité noire. Favis jaunes.

Fig. 47.

*Thinophilus hilaris*, ♂, patte iii.

Antennes noires, tous les articles largement jaunes à la face ventrale, 3 arrondi, plus large que long. Mésonotum

vert, à facies longitudinales brunes mal définies; acrosticales absentes, 6 d.c. la dernière seule bien développée 2 scutellaires. Flancs vert terne, les soies propleurales blanches. Abdomen vert, les bords latéraux à épais poudré blanc, à pilosité noire. Hypopyge noir, les lamelles externes jaunes, triangulaires. Hanches i. jaunes, à villosité noire longue mais peu fournie; ii. et iii. noires, iii. avec une soie externe. Trochanters jaunes. Pattes jaune clair, les articles des tarses noirs à l'apex, les deux derniers presque entièrement. Patte i.: fémur, face ventrale, à la base, avec 2-3 soies fines, longues comme le travers. Patte ii.: fémur, face ventrale, 2 séries de soies noires, fines, rigides, les médianes 1 fois $1/2$ aussi longues que le travers. Tibia, face dorsale, 2 chètes antérieurs, 1 postérieur; face ventrale, 1 antérieur, 1 postérieur. Patte iii.: (fig. 47): fémur, face ventrale, une ciliation noire, longue surtout sur le tiers basilaire où elle égale 1 fois $1/2$ le

Fig. 48.

*Thinophilus hilaris*, sp. n., aile.

travers. Tibia, face dorsale, 3 chètes antérieurs, 3 postérieurs, face ventrale, sur les $2/3$ basilaires, une longue ciliation fine, noire, en plusieurs rangs, 3 fois aussi longue que le travers. Tarse aussi long que le tibia; protarse un peu plus long que l'article suivant. Ailes (fig. 48) teintées de rouille, sans taches; nervures noires, 3 et 4 parallèles; transverse postérieure égale aux $3/4$ du segment apical de la 5^e. Balanciers jaunes. Cuillerons jaunes à cils jaunes. Long. 3.5 mm.

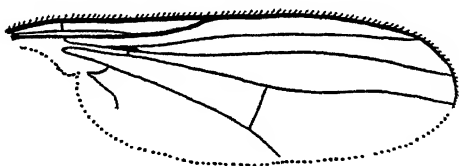
Femelle semblable au mâle. Fémurs ii. et iii. et tibia iii. sans ciliation; tibia ii., face ventrale, 1 chète antérieur, 1 postérieur.

S. Formosa, Takao (*H. Sauter*). Type au Muséum de Berlin.

4. *Thinophilus scutohirtus*, sp. n. (Fig. 49.)

Femelle.—Front terni par un épais givré brun chocolat ; un chète orbitaire robuste. Face entièrement voilée par un épais satiné fauve, de largeur moyenne égale aux $\frac{2}{3}$ d'un travers d'œil. Palpes jaune rougeâtre, à pilosité noire. Favis pâles. Yeux à pubescence blanche. Antennes noires, tous les articles rouge au bord ventral ; soie 1 fois $\frac{1}{2}$ aussi longue que l'antenne. Mésonotum complètement terni par un poudré brun ; 8-9 d.c., certaines plus courtes, mais les postérieures pas plus longues que les antérieures ; à l'extrémité de chaque série, vers l'intérieur, un groupe de 3-4 chètes supplémentaires. Chétules

Fig. 49.



Thinophilus scutohirtus, sp. n., ♀, aile.

huméraux nombreux. Propleures avec deux buissons de soies folles blanches. Écusson couvert de chétules, 2 chètes marginaux robustes. Abdomen vert bronzé, peu brillant. Hanches noires, grises par l'effet du poudré blanc, toutes à vestiture exclusivement blanche. Trochanters et pattes jaune rouge ; au tarse i. les 4 derniers articles bruns ; aux tarses ii. et iii. le protarse est brun à l'apex, les autres articles sont bruns, étroitement rouges à la base. Ailes (fig. 49) légèrement teintées de rouille, les nervures brun jaune, jaunes à la base de l'aile ; une trace de nimbe à la transverse postérieure et de tache à la 4^e longitudinale, sur la bosse alaire. Balanciers jaunes. Cuillerons jaunes à cils blancs. Long. 5 mm.

Mâle inconnu.

Queensland, "a large beach fly" (*Dr. T. L. Bancroft*).
Type au British Museum.

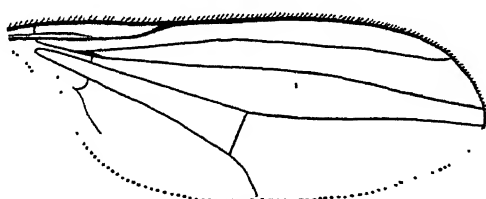
VII. MEDETERINÆ.

Genre MEDETERA Fisher.

Medetera Salomonis, sp. n. (Fig. 50.)

Femelle.—Front à poudré gris blanc. Face à fond vert métallique visible malgré un poudré gris blanc. Cils postoculaires inférieurs blancs. Antennes jaune rouge, l'article 3 noir, arrondi, plus large que long; soie aussi longue que la tête. Mésonotum vert, terni par un léger givré blanc; acrosticales bisériées, les postérieures plus longues que l'intervalle entre les deux séries; d.c. de longueur croissante, précédées d'une série de microchètes; 4 scutellaires, les latéraux plus faibles. Abdomen vert

Fig. 50.



Medetera Salomonis, sp. n., ♀, aile.

bronzé, à vestiture noire. Hanches noires à vestiture noire; i. à pilosité courte. Trochanters et pattes noirs; fémur ii. jaune à l'apex, les tibias et tarses ii. et iii. rouges, les derniers articles noirs. Tibia ii.: un chète dorsal, au tiers basilaire, protarse iii. égal aux $\frac{3}{5}$ de l'article suivant. Ailes (fig. 50): convergence des nervures 3 et 4 égale à $\frac{2}{5}$, transverse postérieure un peu plus courte que la section apicale de la 5^e. Balanciers jaunes. Cuillerons jaunes à cils jaunes. Long. 2.25 mm.

Mâle inconnu.

Solomon Is., Guadalcanal, Rere, 18. viii. 34 (*R. A. Lever*); Solomon Is., Russell Is., Pepesata, 10. xi. 34 (*R. A. Lever*). Type au British Museum.

VIII. *NEUROGONINÆ*.Genre *NEUROGONA* Rond.

1. *Neurogona angulata* Meij. Ceylon (*A. Rutherford*).
2. *Neurogona denudata* Beck. S. Formosa, Kosempo (*H. Sauter*).
3. *Neurogona signata* Par. Burpengary, S. Queensland (*Dr. T. Bancroft*).

Femelle.—Semblable au mâle. Face jaune, large comme le tubercule ocellaire. Palpes jaunes et non blancs. Abdomen : tergites 2-5 largement noirs à la base. Hanche i. à soies apicales noires. Patte i. : tarse 2 fois aussi long que le tibia, protarse presque aussi long que le reste. Patte ii. : tibia, face ventrale, avec 3 chètes antérieurs, un postérieur. Tarse 1 fois 1/2 aussi long que le tibia, protarse un peu plus long que le reste. Protarse iii. plus court que l'article suivant.

4. *Neurogona squamifera* Par. Siam, Bulsit Besar (*A. C. Robinson and N. Annandale*).

Mâle (complément à la description du type).—Occiput avec 1 chète de chaque côté, une paire de chètes postverticaux faisant série avec les soies postoculaires. Tarse i., les écailles dorsales des articles 4 et 5 très caduques, souvent toutes tombées. Patte ii. : tibia et protarse jaunes, le reste noir ; tibia, face dorsale, 3 chètes antérieurs, 3 postérieurs, tous robustes, un ventral antérieur, un seul chète apical bien développé. Tarse simple, 2 fois aussi long que le tibia ; protarse légèrement plus long que le reste du tarse, muni de 2 chètes remarquables, l'un ventral, à la racine, l'autre dorsal, peu après le milieu.

Femelle.—Dans l'ensemble semblable au mâle. Article 3 des antennes un peu plus long que large. Face un peu moins large que le tubercule ocellaire. Mésonotum comme chez le mâle. Abdomen : les tergites 2, 3, et 4 très largement noirs à la base, 5 entièrement. Patte i. : tibia sans aucun chète apical ; tarse presque 2 fois aussi long que le tibia, protarse long comme les deux articles suivants réunis, les articles de longueur régulièrement décroissante.

Patte ii. : tibia, face dorsale, 3 chètes antérieurs, 3 postérieurs, 1 ventral antérieur. Tarse 2 fois aussi long que le tibia. Protarse aussi long que le reste, pourvu des mêmes chètes que le mâle. Portarse iii. de peu, mais nettement plus court que l'article suivant. Ailes comme chez le mâle.

XIII.—*Biology and Morphology of the Sagrinae*
(Chrysomelidæ, Coleoptera). By S. MAULIK.

[Plate III.]

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INTRODUCTORY REMARKS.

In 1773 D. Drury published a description and an excellent coloured drawing of a species which he called *Tenebrio femoratus* (Ills. exot. Ins. ii. London, p. 64, pl. xxxiv. f. 5). He says he did not know the locality where it was taken, having purchased it together with another insect at a sale of the late Mr. Leman's curiosities. His writing suggests that he had one example before him. In 1776 J. H. Sulzer published a short description of an insect named by him *Tenebrio viridis*. He also gives a figure which, in my opinion, is not so good as Drury's, but recognizable as the same species. The locality given by him is America, which is obviously an error, because no such species has yet been discovered there (Abgekürz.

Gesch. Ins. ii., Zurich, p. 64, pl. vii. fig. 8). Sulzer quotes Drury's work, but the insect before him, he writes, differs in being entirely green. In 1781 J. C. Fabricius recognized that Drury and Sulzer were dealing with the same species, but put it in the genus *Alurnus* (Syst. Ent. 1775, p. 94), which he erected in 1775 for a South American species (Spec. Ins. i. 1781, p. 115). In 1792 J. C. Fabricius removed Drury's species from *Alurnus* and erected a new genus *Sagra* for its reception (Ent. Syst. i. 2, p. 51), the locality given being "India orientalis." Although he does not say it, Drury's *femorata* must be the genotype of *Sagra* (fig. 1). The specimen which Fabricius had before him is in Banks' collection in the British Museum, and I have examined it. The probability is extremely great, almost amounting to a certainty, that the insects which the three writers had before them represent one and the same species. At least I have no doubt in my own mind.

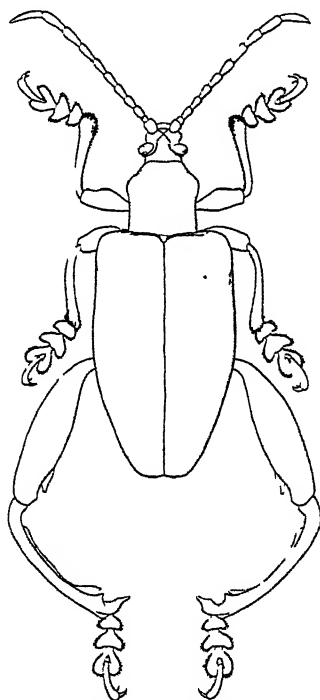
This, then, is the species round which the subfamily has been built. The more examples resemble *Sagra femorata* the greater is their affinity to it, and should be included in the subfamily; and the greater the deviation from the type the less is their affinity to the species grouped under the subfamily. It is proposed here to study it in its various aspects, namely, structure, biology, morphology of the immature forms as far as they are known, food-plants, habits, and geographic distribution.

CHARACTERISTICS OF THE SUBFAMILY. (Text-fig. 1.)

The most characteristic feature of the beetle is the large hind legs with the femora thickened and the tibiae elongated. It should be pointed out that in this case the femur, though thickened, does not contain the organ which I showed (Proc. Zool. Soc. 1929, pp. 305-8) to be the special character possessed by all members of the Alticinae and not by other groups in which there may be insects with thickened hind femora. The form of the body is another important character. It is broad at the base with square shoulders, with the sides parallel nearly up to the middle and then gradually narrowing to the apex. The shoulders are prominent, and a certain basal area on each elytron between the shoulder and suture is convex, so that a furrow is formed between them. The relation between the breadth of the prothorax and that of the base of the

elytra is constant throughout the subfamily, the former being much narrower than the latter. The head is exserted, and in its total length it is only slightly shorter than the pronotum. When the head is stretched out one notices the following :—The neck is narrow behind the eyes, which are prominent, being very strongly convex. Seen from above, on the upper surface two deep channels

Text-fig 1



Sagra femorata Drury, ♂. (Somewhat diagrammatic.)

obliquely cross one another, dividing it into four portions. one frontal, two lateral, and the fourth posteriorly placed. the frontal portion forming the posterior part of the clypeus. The globular base of each antenna articulates in each lateral lobe. The clypeus is large, quadrate in front and triangular behind, with a horizontal deeply impressed line between them. The labrum is broader

than long and completely enclosed in the large mandibles, which hide from view from above all the other mouth-parts when in repose. The maxillæ with its pair of well-developed palpi, the labium with its pair of well-developed palpi, the mentum and submentum are easily recognizable. Looking at the mouth-parts sideways their exerted nature is best seen. An eye does not encircle the base of antenna to such an extent that a portion of it can be seen from above. In these two characters the *Sagrinæ* differ from the *Lamiidæ* and *Cerambycidæ*, with which certain relationship can be recognized. In the latter families the mouth-parts are placed, so to speak, almost in a vertical plane, and the eyes encircle the bases of the antennæ to such an extent that some portions of the former have become vertical.

Throughout the subfamily there is a fairly constant relation between the breadth of the prothorax and that of the base of the elytra, which is from a little more than three times to less than four times as wide as the prothorax.

The body is completely hairless above, and on the underside almost so except for a few sparsely distributed hairs on the abdominal sternites, but in the males this condition is more marked, especially on a certain middle longitudinal portion of the basal abdominal sternite, on the edges of the other sternites, and sometimes on the inner side of the hind tibiæ.

The body above is usually punctate, the punctures being sometimes very sparsely distributed and sometimes, mostly in the African species, fairly closely placed. The punctures have never become coarse, and in no species have they formed a rugose surface by coalescing with each other. When they are sparse they may be much finer and sparser on the pronotum than on the elytra on which the scattered punctures tend to form longitudinal rows. When they are well developed they are equally well developed on the pronotum as well as on the elytra. In the Asiatic species, in general the elytral punctures are without any definite arrangement, while in the African species they show arrangement in longitudinal series. The underside is hardly punctate, having a few fine and scattered ones, but often more on the thickened hind femora and legs.

On the whole the subfamily can be said to contain brilliantly coloured species, the Asiatic species showing

more brilliance than the African ones, which tend to become dull, opaque and sombre. The prevailing colours are green, blue, violet, and various mixtures of these. There is no absolutely unrelieved black; for example, in *nigrita* from Ceylon, if many examples are black there are some in which blue-green predominates. The colours do not form a pattern. If some have been included in this subfamily they should be regarded as deviations from the normal type of this group. Owing to the colour variation within a species a great number of synonyms have arisen. Although entomologists in the past could not do better than propose new names when something relatively unusual happened, in future, knowing this characteristic of the group, one should satisfy oneself by studying breeding habits if possible, if not, by considering the evidence of the group as a whole that one is really dealing with a new species. In most cases the body-colour is uniform—that is, if it is violet every part is violet—only in a few cases are there more than one colour, and when it is so they are of the brilliant group mentioned above.

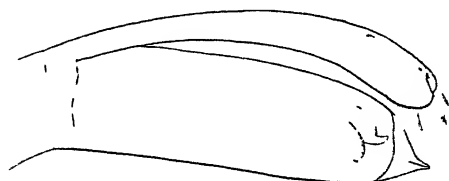
Another characteristic of the group is the occurrence of small examples within the limits of a species. These may be females as well as males. A single specimen of this kind would present considerable difficulties to the systematist. It should be remembered that one of the habits of the species of this group is to live and feed in confined places such as the soft tissues of the host-plant. I draw attention to the fact that this should not be explained merely as a result of lack of food, because there are other things that can happen in the organism producing the same result.

HIND WING. (Text-fig. 2.)

There are no wingless species in this group. In the hind wing, owing to the fact that in repose it is folded under the elytron, the apical portion is free from veins, that is to say, no veins run the whole length of wing from base to apex. But the basal portion—nearly two-thirds of the total area—shows strong veins although much reduced in number and modified in relationship to one another. In the diagram I have indicated the veins by the generally adopted symbols, but their application to the parts involving interpretation is mine. Whatever

a diagram, because to enter into morphological discussions about the ædeagus would not be in keeping with the

Text-fig. 3.

*Ædeagus of Sagra femorata* Drury.

scope of the present study. The figure gives an idea of its structure and serves as a datum for future studies.

SEX-RATIO.

When possible data regarding sex-ratio should be recorded, because they are important from many points of view. Having a large number of specimens of *Sagra femorata* Drury before me I take the opportunity of making the following statements.

From three collections the ratio can be summarized as percentages, males 34.37 per cent.; females 65.63 per cent.

From one collection in *Sagra buqueti* Lesson the percentages are males 40 per cent.; females 60 per cent.

These are only samples drawn from a population. It is possible that these percentages will be helpful in estimating some corresponding numbers which inhere in larger complexes.

FOOD-PLANTS OF *SAGRA* AND BIOLOGICAL NOTES.

The larvæ are internal feeders. Young larvæ bore into the stems of the plants and feed and grow inside the tissues of the plant. At these places swellings appear (Pl. III.). One to as many as twenty larvæ may be found in a swelling. The larva constructs a cocoon of protective material and pupates in it, emerging to the outer

world from the swelling as imago. Thus the larva passes its whole life surrounded by its food-material. As they attack plants which supply some food-stuffs to man this group of Chrysomelid beetles has some economic importance.

Sagra femorata Drury.

INDIA : United Provinces, Dehra Dun, New Forest.
Dolichos lablab Linn. (Leguminosæ).

EASTERN HIMALAYAS : Darjeeling, Kalimpong, Samsing, 1800 ft. altitude. *Faba vulgaris* (Leguminosæ).

INDIA. *Mucuna atropurpurea* (Leguminosæ).

CHINA. *Ipomœa* (Convolvulaceæ).

Sagra longicollis Lacord.

BURMA : Katha. In teak sapling, *Tectona grandis* Linn. (Verbenaceæ).

Sagra nigrita Olivier.

SOUTH INDIA. CEYLON. *Dolichos lablab* Linn.

Sagra splendida Olivier. }

Sagra purpurea Licht. }

CHINA : Canton, Whampoa, xii. 1869 (*Dr. Auzoux*). Hong-Kong. In the stem of *Dioscorœa batatas* Decaisne (Dioscoreaceæ).

The tubers of *Dioscorœa* are valuable as food for man.

INDO-CHINA : Cho-ganh. North Annam. *Aleurites* (Euphorbiaceæ); *Melia* (Meliaceæ); *Tectona* (Verbenaceæ); *Citrus* (Rutaceæ); *Phaseolus* (Leguminosæ); and the coffee-plant.

With regard to these plants see note below in the section "Annotated Bibliography" under M. Duport.

In my opinion the above names of insects have been applied to one and the same species and should be considered synonyms. The species shows great adaptability as regards food-plants and has a wide distribution.

Sagra buqueti Lesson.

JAVA : Mangroves, *Rhizophora* (Rhizophoraceæ).

Sagra jansonii Baly.

BURMA : Tharrawaddy.

According to the records of the Dehra Dun Forest Research Institute this species has been obtained from the wood of teak saplings when badly grown stems were cut back in a five-year-old plantation.

In this connection it is interesting to note the following observation from the same source :—Various creepers [including *Thunbergia grandifolia* (Acanthaceæ)] encircle the stems of vigorously growing teak saplings and become partly occluded. The larva living in the creeper may continue its gallery into the teak stem and there pupate.

Sagra buqueti Lesson and *Sagra jansonii* Baly are in my opinion distinct species, showing good morphological differentiation.

Sagra femorata Drury. Larva (text-fig. 4).

Larva (alcohol specimen).—

	mm.
Greatest length of the bent body	21·00
Breadth across prothorax	6·00
" " mesothorax	8·00
" " fifth abdominal segment .	10·50
" " ninth " " " " " " " "	6·00
" " tenth (anal) segment	2·50
Length of the " " " " " " " "	2·00
Length of head outside body (in repose) .	2·75
Breadth of head " " " " " " " "	3·00
Total length of the dissected head "	5·00
Greatest breadth " " " " " " " "	3·00
Depth of body at the middle	9·50

Pupa (alcohol specimen).—

Length	22·00
Greatest breadth	11·00

Very large imago.—

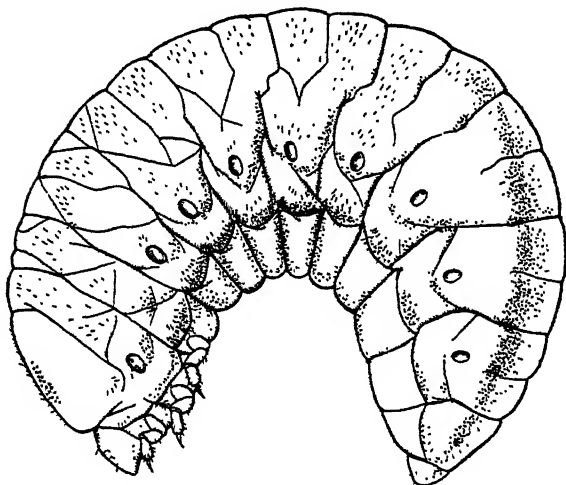
Length	24·00
Greatest breadth	12·00
Length of pronotum	11·00
Breadth of pronotum at base	5·00

Very small imago.—

	mm.
Length	13·00
Greatest breadth	5·50
Length of pronotum	3·50
Breadth of pronotum at base	3·00

Body fleshy, creamy white, head dark brown, spiracles lighter brown ; at the fourth and fifth abdominal segments bent in such a way that the back is convex, the end of the body approaching the head ; fourteen-segmented (1 cephalic+3 thoracic+10 abdominal).

Text-fig. 4.

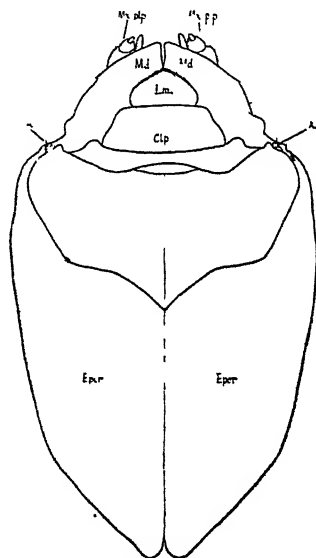


Larva of *Sagra femorata* Drury in its natural position of the bent body.

Head compared with the size of prothorax very small (see the measurements), parallel-sided, narrowing posteriorly ; retractile, with considerable power of movement in and out of the prothorax ; those parts that are never withdrawn into the prothorax are more strongly chitinized ; clypeus, labrum (with a fringe of hairs at the edge), two mandibles, two maxillæ (with two pairs of palpi), labium (with two palpi) well-developed ; seen from above clypeus, labrum and mandibles are visible (text-fig. 5),

a more strongly chitinized area delimited on each side by an irregularly oblique suture, both meeting in the middle just behind the area and continuing as one to the end, three hairs in a triangle on each side of the middle lines, six in all on the area ; seen from underside maxillæ, labium, mentum and submentum are visible, large opening of head ovoid, with a well-defined margin all round ; on each side of the dorsal strongly chitinized area on the

Text-fig. 5.

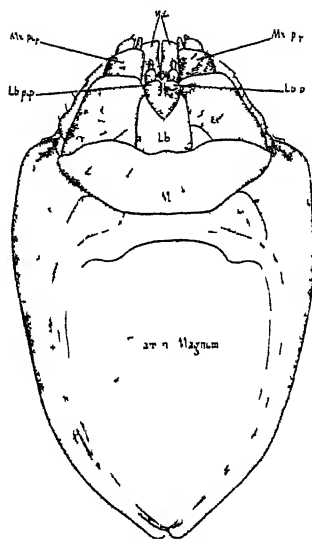
Dorsal aspect of head of larva of *Sagra femorata* Drury.

Epcr., epicranium ; *A.*, antenna ; *clp.*, clypeus ; *lm.*, labium ;
Md., mandible ; *Mx.plp.*, maxillary palpi.

front margin is a two-segmented antenna (text-fig. 5, *A.*) with a large round base, the apical segment having two sensory structures on its round upper surface, the antenna can only be seen from the dorsal side ; on the outer side of the antenna at each corner two or three hairs ; on the inner side of a condyle of a mandible is a large hair, and also a smaller one somewhat in front of it. *Thorax* : seen from the front a large more strongly

chitinized area covers almost the whole dorsal surface of the tergite of the prothorax, anterior portion of the area smooth and free of tubercles and projected into four lobes, two on each side of the longitudinal middle line ; along the middle a faint, impunctate, whitish line, on each side of which is distributed a mixture of larger and smaller dark brown tubercles, the former kind being more around the middle and gradually becoming smaller as the boundaries of the area are approached. Seen from above.

Text-fig 6.



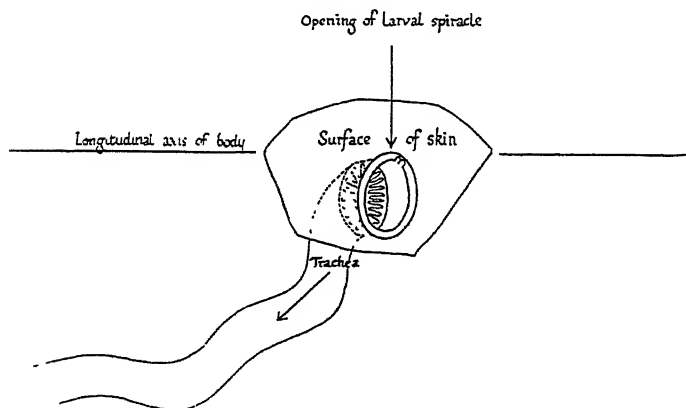
Ventral aspect of head.

Mt., mentum ; *Lb.*, labium ; *Lb.plp.*, labial palpi ;
Mx.plp., maxillary palpi ; *Md.*, mandible.

tergite of mesothorax with a narrow anterior arcuate portion and without a posterior arcuate portion ; tergite of the metathorax with both anterior and posterior arcuate portions, the former being larger ; in neither the meso- nor the metathorax is a median transverse impressed line. *Abdomen* : tergites of first to third segments with both anterior and posterior arcuate portions, the former being in each case larger than the latter, and with a median transverse impressed line ;

in tergites fourth to seventh the anterior arcuate portion is losing its well-defined boundary while the posterior portion has disappeared, but the median impressed line is present; in tergites eighth and ninth all arcuate portions have completely disappeared but the median impressed line is present. In no case the median impressed transverse line reaches the spiracle in the lateral area of the tergite. The tenth segment is a rectangular piece projecting from the ninth, with all the edges rounded and with the anus, a transverse slit, dorsal. Seen sideways, two longitudinal series of swellings, one upper and the other lower, are perceptible, the lower series representing the lateral

Text-fig. 7.



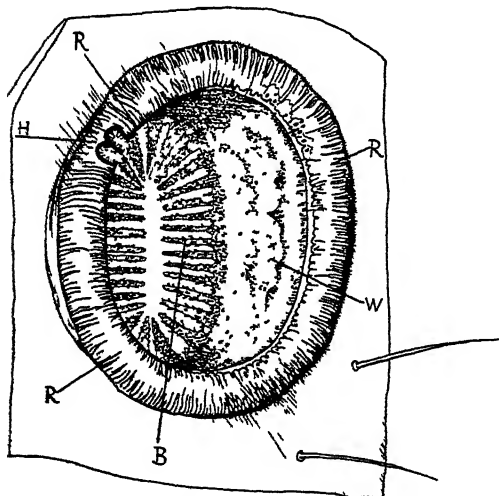
Schematic drawing showing a fragment of larval skin containing a spiracle. Observe that the long axis of the spiracle is at right angles to the long axis of the body.

projections found in many larvæ. Each individual swelling of the lower series is more pronounced than the corresponding one of the upper series. All segments, except the head and the ninth and tenth abdominal, show this characteristic. Between these in the middle lateral area is a *spiracle* (text-fig. 4) in each of the first to eighth abdominal segments. The first spiracle is between the pro- and mesothorax. All the nine spiracles are of equal size.

The shape of the external opening of a spiracle is elliptical, the shorter axis being along the longitudinal line of the body (text-fig. 7). Seen from above the rim or ring

surrounding the orifice is convex with the inner edge sharp. Looking into the spiracle one notices an elliptical chamber 2.00 mm. in depth (text-fig. 8), at the bottom of which appears to be a slit which is the opening into the trachæa, being protected by a series of flexible structures. Each of these proceeds from the ring towards the interior. The inner surface of the walls of the chamber possesses specialized tracheoles all contributing to the function of respiration (text-fig 8, *W*). The ring is shown in a greatly enlarged drawing (text-fig. 8, *R*) displaying the columnar

Text-fig. 8.



Text fig. 8 A.



Text-fig. 8.—Spiracle of larva of *Sagra femorata* Drury (greatly enlarged) shown on a fragment of skin. *R*, outer ring or rim, *H*, the hook-structure; *W*, specialized wall of the spiracular chamber, *B*, the structure at the bottom of the chamber opening into the tracheal tube (see text-fig 8).

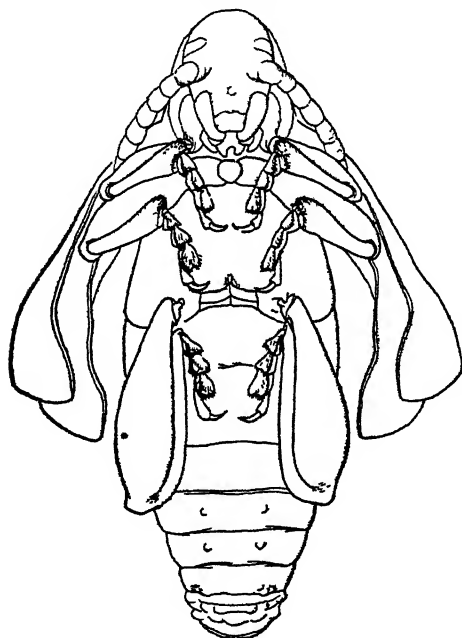
Text-fig. 8 A —Shows the hook-structure at which the outer rim is joined to upper surface of the spiracular chamber.

structures which are always found in strongly chitinized portions forming an edge of any part of the body. From the lower surface of the ring the chamber can be easily separated. When it is detached the ring shows a break at one point at which is fitted a hook-like structure (text-fig. 8 A) which belongs to the upper edge of the chamber.

When it remains attached to the ring, seen from outside it shows a notch at this point.

In giving the description of a spiracle in some detail I have in mind the fact that its structure is used in systematics and also that it provides data for the study of comparative anatomy of spiracles. Some features mentioned here are not found in studies on spiracles already published; and it should be remembered that

Text-fig. 9.



Ventral aspect of pupa of *Sagra femorata* Drury.

the larvæ are internal feeders living in constrained position surrounded by plant-tissues.

Seen from the underside each of the three thoracic segments bears a pair of well-developed *legs*, each leg being composed of coxa, femur and tibia surmounted by a claw. Compared with the body of the larva the legs are very small. The *sternites* first to ninth are not markedly differentiated into portions as the tergites are although faint divisions are recognizable, particularly the lateral

prominences. At first sight the body of the larva appears to be hairless, but under a strong lens or a higher magnification the distribution of the *hairs* is as follows:—The hairs are very sparsely distributed. Even where they can be called comparatively crowded the distribution is sparse. On the dorsal area there are only a few scattered hairs here and there. On the lateral areas, especially on the convex portions or swellings, they are more numerous. On the lower surface the distribution is similar to that of the upper surface. The lateral and lower surfaces of the tenth segment and of the legs have more hairs which look stiffer. A single hair is thicker in the basal portion, becoming thinner as the apex is approached. Some are longer than others, the longest and stiffest being on the legs, where they assume a bristly appearance.

Pupa.—The pupa has all the characters of the mature beetle and none peculiar to itself, as I have shown to be the case in some genera of the Chrysomelidæ. In the abdomen, apparently, there are nine tergites and seven sternites. There are seven pairs of spiracles all situated dorsally along a lateral area. Each spiracle of the first pair is the largest and that of the last pair is the smallest, those of the intervening ones being equal to one another in size. A spiracle is placed forward almost near the front edge of the tergite.

Cocoon.—A cocoon is made by the larva in which it pupates. The cocoon is cylindrical in shape, with both ends rounded, the posterior being broader and dark brown in colour. The material of which it is made is brittle. The interior of the cocoon is smooth and shining, as if it is varnished (see also the Bibliography).

GEOGRAPHIC DISTRIBUTION OF THE *SAGRINÆ*. (Text-fig.10.)

According to Junk & Schenkling's 'Coleopterorum Catalogus' (1913) there are fourteen genera divided into five groups, of which the genus *Sagra* is the largest, containing about sixty species from Africa, Asia, Indo-Malayan region and some of the Pacific islands, but not from Australia or New Zealand. Of the remaining thirteen genera *Aulacoscelis* Chevrolat, 1843, containing twelve Mexican species, cannot be included in the *Sagrinae* at all. Jacoby put the genus in its present position without sufficient grounds. I do not wish to burden this paper with the arguments in favour of my judgment. The

monotypic genus *Atalasis* Lacordaire, 1845, having the species *sagroides* from Argentina, although it shows deviation from the main body of the subfamily, should be included in it. The rest of the eleven genera contain twenty-nine species, all from the Australian regions. I consider that these small genera, containing a few species each, are stragglers, so to speak, in the evolution of the group, or

Text-fig. 10.



Map showing the geographic distribution of the Segrinæ. *S*=*Sagra*. *Atalasis* is the name of a monotypic genus. *Rhagiosoma* is the name of a genus containing two species.

having descended from the same ancestor, and as a result of being isolated, show considerable deviation in other directions. It is to be noted that in Madagascar both the genus *Sagra* and one non-*Sagra* genus *Rhagiosoma* occur, and that the species of *Sagra* from Madagascar resemble those of Africa.

SYNONYMS OF *SAGRA FEMORATA* DRURY.

In my view the following published names should be regarded as synonyms of *Sagra femorata* Drury, 1773. In drawing up the following list I have taken into account the named species in the collection of the British Museum.

1. *Tenebrio viridis* Sulzer, 1776, Abgek. Gesch. Ins. i. p. 64.
2. *Alurnus femorata* Fabricius, 1781, Spec. Ins. i. p. 115.
3. *Sagra femorata* Fabricius, 1792, Ent. Syst. i. 2, p. 51. INDIA ORIENTALIS.

MR. S. MAULIK ON THE BIOLOGY AND

4. *Sagra purpurea* Lichtenstein, 1795, Cat. Mus. Hamburg, p. 60. CHINA.
5. *Sagra splendida* Weber, 1801, Obs. Ent. p. 61. CHINA.
6. *Sagra splendida* Olivier, 1807, Entomologie, v. p. 497.
7. *Sagra nigrita* Olivier, 1807, Entomologie, v. p. 500. CEYLON. SOUTH INDIA.
8. *Sagra chrysochlora* Lacordaire, 1845, Mon. Phyt. i. p. 35.
9. *Sagra druryi* Lacordaire, 1845, l. c. p. 32.
10. *Sagra festiva* Lacordaire, 1845, l. c. p. 35. BORNEO.
11. *Sagra speciosa* Lacordaire, 1845, l. c. p. 38. JAVA.
12. *Sagra superba* Lacordaire, 1845, l. c. p. 39.
13. *Sagra quadricollis* Lacordaire, 1845, l. c. p. 40.
14. *Sagra weberi* Lacordaire, 1845, l. c. p. 50. ASSAM.
15. *Sagra mutabilis* Baly, 1864, Ann. & Mag. Nat. Hist. (3) xiv. p. 433. SIAM.
16. *Sagra longipes* Baly, 1877, J. Linn. Soc. Lond. xiv. p. 337. BURMA.
17. *Sagra olivieri* Weise, 1913, Wien. Ent. Zeit. xxxii. p. 18.

ANNOTATED BIBLIOGRAPHY.

1856. Mr. Bowring exhibited pupa cases of *Sagra femorata* apparently formed of excrement. Trans. Ent. Soc. Lond. iv. 1856, p. 20.

"The pupa-cases of *Sagra*, now exhibited, were discovered by Lieut.-Col. Dunlop, R.A., in the interior of the stem of large climbing species of *Ipomœa*, which trails over a fine row of bamboos in the rear of Head-Quarters House. In clearing away the creeper he observed that the stem was considerably thickened in some places; and on cutting open the swellings the pupæ were found. The larva I have not yet met with; but being now acquainted with the habitat of the insect, I have little doubt of falling in with it on my return to China."

1862. SNELLEN VAN VOLLENHOVEN. "Iets over Het cocon van *Sagra boisduvallii* Dej." Tijdschrift voor Entomologie, v. 1862, pp. 97-99, pl. v. figs. 6-9.

Four figures are given, two of the cocoon and two of the beetle. One of the cocoon drawings is in colour and the other in black and white partly open showing the insect *in situ*. Of the beetle drawings one shows the underside and the other a side view. The name *boisduvali* Dupont is a synonym of *buqueti* Lesson.

1872. LUCAS, H. "Transformations du *Sagra splendida* Fabr. *purpurea* ejusd." Ann. Soc. ent. Fr. (5) ii. 1872, Bull. pp. xciii-xciv.
1873. LUCAS, H. "Remarques sur la Vie évolutive du *Sagra splendida*." Ann. Soc. ent. Fr. (5) iii. 1873, pp. 231-248, pl. vii. figs. 1-11.

1886. LUCAS, H. "Metamorphose du *Sagra buqueti* Lesson." Ann. Soc. ent. Fr., Bull. (6) vi. 1886, pp. lxxxiv-v.

Of the three papers by Lucas the first states that he has received larvæ, swellings in plants etc. from China sent by Dr. Auzoux and briefly describes the conditions under which the insect lives. The second paper is elaborate, based on the same material. Some relationships are discussed which at present do not seem important as they did in his time. The third is a short note concerning the Dutch author's discovery of the pupa of *buqueti* which has a similar mode of life as *femorata*. It does not give any information which would supply data for a comparative study of the larvæ of *Sagra femorata* and *S. buqueti*.

1915. DUFOUR, M. "Rapport à Monsieur le Président de la Chamber d'Agriculture du Tonkin et du Nord-Annam sur les Travaux effectués en 1914 à la Station Entomologique de Cho-ganh." Supplement to Bull. no. 102, Chambre Agric. Tonkin, Nord-Annam, January-February 1915. 46 pp.

In considering the minor pests of the coffee-plant at Cho-ganh the writer suggests that a larva of which the imago is unknown lives in the soil at the base of the plant sometimes at a depth of nearly two feet, and does damage to the parts underground.

He also found at the same locality similar larvæ in diseased or dead wood of the following plants: bancoulter, *Aleurites* (Euphorbiaceæ); lilas du Japon, *Melia* (Meliaceæ); teck, *Tectona* (Verbenaceæ); citronnier, *Citrus* (Rutaceæ). He experimented by putting the larva of one plant into another, and found that they lived perfectly well when thus interchanged; that the larvæ in the upper part of the stem may go to the stem underground without returning to the upper part, and that the larva would even attack the tender part of the wood of the bar of the cage. The imago of these larvæ is unknown.

On another occasion he got imagos of *Sagra purpurea* out of the "galleries" in the stem of haricot, both cultivated and wild *Phaseolus* (Leguminosæ); and in the trunks of citronnier, *Citrus*. Here larvæ are not known. Although not very clearly stated all larvæ are judged from his writing to be stem-borers. It is probable that all these represent a species of *Sagra*. With regard to adaptability to different plants compare the note above in the food-plant section under *Sagra jansoni* Baly.

1915. BEESON, C. F. C. "Forest Entomology." Reprint from Ann. Rep. Biol. Sci. Advice for India, 1913-1914, Calcutta, 1915. 'Economic Zoology,' pp. 8-11.

The only point of interest in this report is that a species of *Sagra* produces bee-holes or cavities in the heart-wood of teak saplings, *Tectona grandis*.

1919. BEESON, C. F. C. "The food-plants of Indian Forest Insects," pt. iii. 'Indian Forester,' Allahabad, xlv. no. 6, June 1919, pp. 312-323.

There are three records of *Sagra* and the food-plants.

1921. SUBRAMANIA IYER, T. V. "Notes on the more important Insect Pests in the Mysore State." Jl. Mysore Agric. & Exptl. Union, Bangalore, iii. no. 1, March, 1921, p. 16.

The life-history of *Sagra nigrita* Oliv. (in my view a variety of *femorata*) was worked out by the late Dr. K. Kunhi Kannan in Mysore. Eggs are laid in the main stems of the climbing bean (*Dolichos lablab*). At these places about two and a half months later swellings appear in which pupation takes place, imagos emerging four to five months after pupation. The total life-cycle occupies about one year.

1931. BÖVING, A. G., & CRAIGHEAD, F. C. 'An Illustrated Synopsis of the Principal Larval Forms of the Order Coleoptera,' 86 pages and 125 plates. Brooklyn Entomological Society, Brooklyn, N.Y., 1931.

Plate 104 contains eight drawings, A-H, showing parts of *Sagra femorata* Jacoby obtained from Malleswar, Mysore State, India. It must be pointed out that Jacoby is not the first describer of the species, and this error should not be perpetuated. Beyond these drawings there is no other information.

SUMMARY.

1. An attempt has been made to view the characteristics of the subfamily as a whole. The structure of imago and immature forms, habits, food-plants, and geographic distribution have been considered. In the light of these considerations the genetic relationship of some species has been restated.

2. The larvæ, so far as known, are borers in creepers and tender wood, causing swellings, and they complete their development inside the plant. The larva makes a cocoon with a black waterproof lining. There is one generation a year.

3. The larva has a small retractile head imbedded in a large fleshy body, and small legs and large spiracles, some structural details of which are illustrated.

4. The food-plants are very varied, there being great adaptability in this respect. The larvæ can transfer themselves successfully from one plant to another and complete their growth in the new host-plant.

5. The species show great variation in colour. The greater the variation the wider the distribution.

6. The species exhibit the phenomenon of producing small examples both male and female.

7. The Segrinæ proper occur in Asia and Africa. These can be clearly seen to have been descended from a common ancestor. Australian species included in this subfamily have considerably deviated from the true Segrinæ. The Mexican species under the genus *Aulacoccelis* Chevrolat cannot belong to this subfamily.

8. Attention is drawn to the chronologically arranged annotated bibliography because it gives additional biological information.

ACKNOWLEDGMENTS.

I am indebted to Mr. J. C. M. Gardner for sending to me larvæ, which are now in the British Museum. He has also kindly placed at my disposal the notes in the records of the Forest Research Institute, Dehra Dun, India. The illustrations are by Brenda Hudson.

EXPLANATION OF PLATE III.

Swellings in the plants inhabited by the larvæ of *Sagra femorata* Drury.
At the place marked by the arrow in the picture an imago is on the point of emergence.

XIV.—*A Synonymic Note on Wania membracioidea Liu (Homoptera, Jassoidea).* By W. E. CHINA, M.A.

IN the 'China Journal' for December, 1939, vol. xxxi. no. 6, pp. 295–297, there is a short paper by Gaines Kan-Chib Liu entitled "On a new Genus of Homoptera from Anhwei." Under the name *Wania membracioidea* the author describes a new genus and species, which he states possesses the chief family character of both the Membracidae and the Jassidae, and which he says is most closely related to *Darthula* in the Membracidae and *Tituria* in the Jassidae. His excellent figures show that *Wania membracioidea* is a species of the well-known genus *Balala* Distant, 1907 (Faun. Brit. Ind., Rhyn. iv. pp. 250–251). Indeed, it is closely related to the genotype *Penthimia fulviventris* Walker (an Indo-Chinese species), and differs principally in the more acute humeral angles of the pronotum. It is possible that these are exaggerated in Liu's figures. The only species of *Balala* other than the genotype is *B. formosana* Kato, 1928, described from Formosa ('Kontyu,' ii. p. 228). This species is unknown to me. While, therefore, it is impossible to say definitely whether Liu's species is actually new or not, his genus *Wania* sinks as a synonym of *Balala* Distant. *Balala* belongs to the family Gyponidae, subfamily Sudrinae. The tendency of the tegmen to be differentiated into two regions, a membranous and a coriaceous one, emphasized by Liu, is found in many Homoptera, and does not show relationship with the Heteroptera. The genus *Darthula* Kirkaldy is not typical of the Membracidae, and is more correctly placed in the Æthalionidae, an isolated family between the Membracidae and Jassoidea.

BIBLIOGRAPHICAL NOTICE.

Life Histories of N. American Cuckoos, Goatsuckers, Humming Birds, and their Allies. By A. C. BENT. Smithsonian Institution, Washington, D.C.

MR. BENT is to be congratulated on completing the thirteenth volume of this series, and he has maintained the high standard of the earlier volumes.

The account of the Carolina Parakeet, the first bird on the list, is melancholy reading, since it became extinct only some

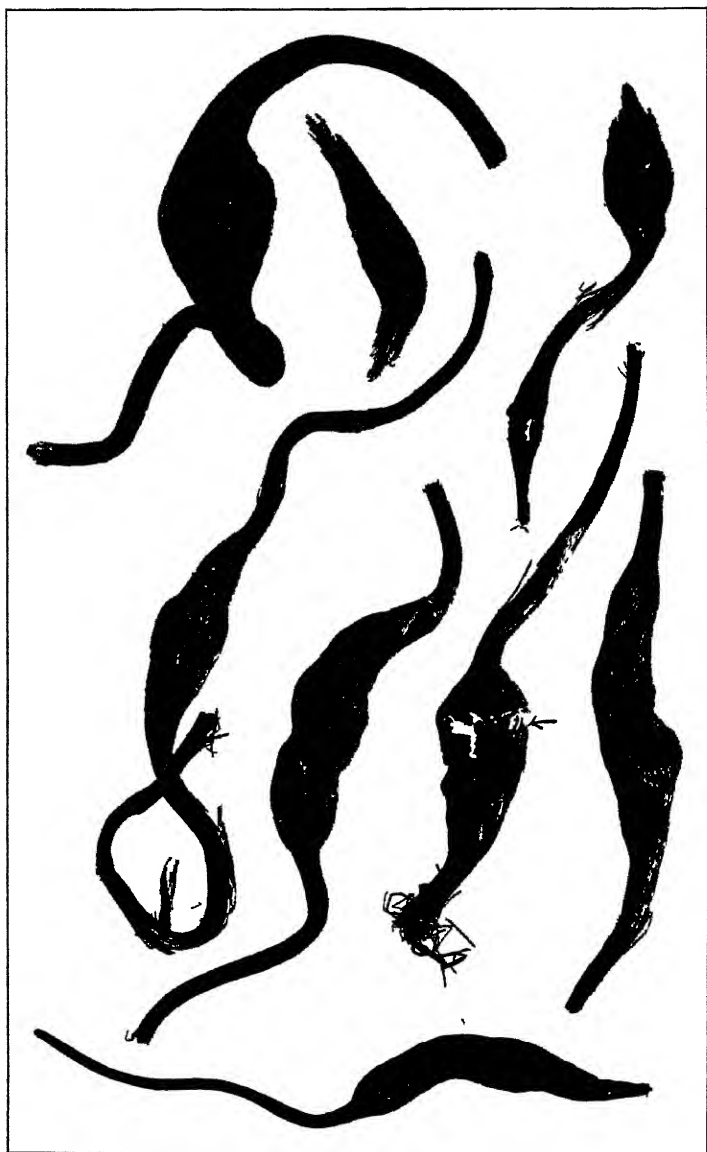
twenty years ago. Formerly great flocks of this species were a feature of the eastern part of North America, but owing to the bird's fondness for grain and fruit the hand of every farmer and orchard-owner was against it. Thousands were shot and large numbers taken by bird-catchers, so that by 1900 its fate was doomed.

There is a good account of that curious aberrant Cuckoo—the Road-Runner, familiar to visitors to the dry country in the south-west. Both the Black- and Yellow-billed Cuckoo rear their own young, but sometimes they also lay in one another's nest or impose on other species. There is a curious case on record of a Yellow-billed Cuckoo which laid two eggs in the newly completed nest of an American Robin. The rightful owner then laid one egg, but took no further interest: along came a Mourning Dove, laid two eggs, and started to incubate alongside the Cuckoo! Unfortunately the story goes no further, as the eggs were taken for collection.

The habits of the North-American Swifts are interesting reading. The Northern Great Swift, for instance, frequently lays its eggs in a very damp situation, at the back of a waterfall or a wet sea-cliff in a Cormorants' colony. The commonest species is the House Swift, which bred in hollow trees before the advent of settlers; but when the new arrivals built chimneys the birds found them more convenient than hollow trees. For a long time there has been a controversy how this Swift collects material for its nest—some said with its bill, others with its feet; now, with the help of a movie camera, it has been proved beyond doubt that the latter method is correct.

The last part of the volume is devoted to Humming Birds, and nineteen species are mentioned. In the account of the Ruby-throated species the author mentions that sometimes it suffers much from frost should it overrun the advance of spring in the northward migration. He also records a case of a bird caught in a spider's web and one which became entangled by the stamens of a pasture-thistle. The Rufous Humming Bird is one of the most brilliant species found in North America, and is of special interest on account of its high northern range in the summer, some birds breeding as far north as Alaska. To reach its winter quarters this tiny creature—in some cases—must travel over 2000 miles.

To those not familiar with this series it should be mentioned that the term "Life History" is used in the very widest sense, and includes migration, nesting, courtship, behaviour and habits.



Swellings in the plants inhabited by the larvæ of
Sagra femorata Drury.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 39. MARCH 1941.

XV.—*The Examples of the Colocolo and of the Pampas Cat in the British Museum.* By R. I. Pocock, F.R.S. (Zoological Department of the British Museum, Natural History).

ALTHOUGH these two South American Cats are not closely allied, their association in a common paper is justified by the confusion between them, discussed by J. A. Allen in 1919, in most of the literature relating to them.

Examination of the specimens in the British Museum has brought to light some previously unrecorded facts and compelled the introduction of a few new names for hitherto unnamed local races of the Pampas Cat (*Lynchailurus*), the granting of generic status to the Colocolo, and the correction of some errors in nomenclature and statements of alleged facts, mostly unavoidable from scarcity of material of the two rare species.

Genus *LYNCHAILURUS* Severtzow.

Lynchailurus Severtzow, Rev. Mag. Zool. (2), x. p. 386, 1858; J. A. Allen, Mamm. Patagonia, p. 183, 1905, and Bull. Amer. Mus. Nat. Hist. xli. p. 374, 1919.

Pajeros Gray, Proc. Zool. Soc. 1867, p. 269.

Dendrailurus Pocock, Ann. & Mag. Nat. Hist. (8) xx. pp. 348-349, 1917 (in part; diagnosis applicable to type of *Lynchailurus*, but not known to apply to the type of *Dendrailurus* Severtzow).

Type of *Lynchailurus* and *Pajeros*.—*pajeros* Desm., of *Dendrailurus*, *colocolo* Ham. Smith, not Molina.

Ann. & Mag. N. Hist. Ser. 11. Vol. vii. 17

Distribution.—From Peru and Matto Grosso to Chili and South Patagonia.

Distinguished in its external characters from the other genera of South American Felidæ by the presence of a spinal crest extending from behind the shoulders to the loins and by the apically more pointed, less rounded, ears, which frequently have a small pencil of hairs at the tip. In the pattern there is no definite white spot behind the ears, which are grey at the base behind, black distally; the crown of the head and the nape are at most indistinctly striped, and the stripes on the tail are never conspicuous, except sometimes at the end; the spinal crest forms a more or less distinct stripe darker than the areas on each side of it; the rest of the body-pattern typically consists on the sides of blotches, many of which run into longitudinal bands obliquely descending from before backwards, but these may be scarcely detectable in the Pampas race; the legs are strongly striped in their upper part; the throat is striped, often heavily, and the belly is marked with conspicuous spots, which occasionally fuse into irregular transverse bands*.

The skull varies so much individually in details that it is difficult to give a precise definition that will distinguish it from the skull of Geoffroy's Cat (*Oncifelis*), but on the average it has a shorter, more abruptly down-bent muzzle, and the tympanic chamber of the bulla much larger, so that in profile view the anterior end of this chamber conceals the anterior end of the inner chamber. But in both these genera the bullæ are very variable in their details†.

* In the possession of the spinal crest and of more pointed, often finely pencilled ear-tips, as well as in the large size of the outer (tympanic) chamber of the bulla, this cat shows an interesting and independently acquired resemblance to some of the Old World Cats of the genus *Felis* and its allies. The expansion of the tympanic chamber of the bulla in the Felidæ is an adaptation to life in open country.

† The examination of a much larger number of skulls than was available to me in 1917 shows that I overrated the systematic value of the structure of the bullæ by assuming the constancy, within specific limits, of the characters pointed out as distinguishing the bulla of *Lynchailurus* from that of other S. American Cats, e.g. *Oncifelis*. In the typical forms of these two the difference is very well marked; but in the race of *O. geoffroyi* named *salinarum* by Thomas, the tympanic chamber is larger than in the typical race, and in *L. pajeros budini* it is noticeably smaller than in the Argentine and Chilian races, *pajeros* and *humana*.

Lynchailurus pajeros Desm.

Since the described forms of this cat are regarded as local races, its characters and distribution are the same as those for the genus. The principal bibliography is entered under that heading and under the subspecies.

Lynchailurus pajeros pajeros Desm.

Felis pajeros Desmarest, Nouv. Dict. Nat. Hist. vi. p. 114, 1816 (based on Le Chat Pampa, Azara, Ess. Quadr. Paraguay, i. p. 179, 1801); and of subsequent writers including Matschie and J. A. Allen, both of whom cited it under the subgeneric name *Lynchailurus*.

Pajeros pampanus Gray, Proc. Zool. Soc. 1867, p. 269 (substituted name).

Felis pajeros crucina Thomas, Ann. & Mag. Nat. Hist. (7) viii. p. 247, 1901; J. A. Allen, Mamm. Patagonia, p. 183, 1905.

Locality of the type of *pajeros* and *pampanus*.—The Pampas to the south of Buenos Ayres between 35° and 36°, S. lat. (Azara); of *crucina*: Santa Cruz, S. Patagonia.

Distribution.—The lowlands of the southern Argentine and Patagonia, in Patagonia from the Atlantic coast to the Chilean boundary, and at least as far south as Rio Gallegos.

Distinguished by the generally dull colour and the comparatively indistinct, sometimes almost obliterated pattern on the upper side of the body.

Two undated skins in the British Museum from Pampa, Argentine, lat. 37° 45' S. (Dr. Hopff) may be taken as representing typical *pajeros*. They differ considerably in colour and pattern. One, a flat skin very like Azara's specimens, is nearly uniformly darkish tawny above, with rich buff under hair, but with scarcely a trace of a spinal stripe or of lateral stripes except low down on the flanks where they are indistinct; there is a good deal of buff on the sides of the belly, and the hairs on the black stripes of the legs are tipped with ochreous. The other (no. 3.2.24.1) has the sides ashy, the head, neck, and shoulders pale tawny, the under hairs of the back much paler and the pattern much better defined, consisting of a blackish and buff spinal area and of lateral stripes, which are faint dorsally but become gradually more and more conspicuous and blacker lower down, and jet black on the belly, where they form irregular transverse lines; there is a slight buffy wash on the throat and sides of the abdomen, but there is no red on the pattern anywhere.

When Thomas described *crucina*, based on a specimen collected by Darwin at Santa Cruz, Patagonia, and figured and described as *pajeros* by Waterhouse (Voy. of the 'Beagle,' Mamm. p. 18, pl. ix. 1838), he does not appear to have had any Argentine skins wherewith to compare the type. He accepted the statement of D'Orbigny and Gervais (Mag. Zool. ii. text, 1844) that southern representatives of the species differ from northern in the more or less complete effacement of the pattern above and the generally less yellow hue. He cannot, moreover, have read the description of the co-types by Azara, who, after stating that the general colour above appears clear brown, but "careful scrutiny" shows a spinal stripe and stripes along the sides nearly parallel to it, concludes with the remark that "all the bands are so little perceptible that it would perhaps have been better not to mention them." It requires no "careful scrutiny" to detect the spinal and lateral stripes on the faded type of *crucina*, which was claimed to have the dorsal pattern less well marked than in typical *pajeros*. It is, moreover, much "yellower" than Azara's skins and than the two from Pampa above described.

Other skins from Patagonia in the British Museum are from the Senguer River, Chubut (99.2.22.3), and three from Nahuel Huapi on the Chilian border (Holdich, nos. 3.11.5.5-7). In their generally ashy-grey hue they are like the second of the two from Pampa, above referred to, but differ individually in details. In one from Nahuel Huapi the pattern on the flanks is very indistinct, the stripes on the throat are decidedly buffy, and this same tint pervades the backs of the hind legs, of the fore legs behind below the wrist, and the sides of the abdomen. In the other the pattern is much better defined, the throat stripes are black, and there is hardly any buff on the other parts mentioned.

J. A. Allen accepted *crucina* as a valid subspecies, without comment, and assigned that name to a specimen from Rio Gallegos, which does not appear to differ appreciably from the grey specimen from Pampa and from the one from Nahuel Huapi, which shows the pattern on the back and flanks. Some notes on the skull of this race are given under the next subspecies.

*Lynchailurus pajeros huina**, subsp. n.

Felis pajeros Gay, Hist. de Chile, Zool. i. p. 69, pl. iv. 1857; Philippi, Arch. Naturg. 1873, pl. iii. figs. 3 and 4.

Felis colocola Thomas, according to his identification of specimens in the British Museum; and also apparently Matschie, SB. Ges. Nat. Fr. Berlin, 1894, p. 60. (Not *Felis colocola* Molina, as determined by Philippi, Arch. Nat. xxxvi. pt. i. p. 43, pl. i. 1870, also xxxix. p. 11, pl. 3, 1873.)

Locality and history of the type.—The range of mountains over Lake Catapilco, near Aconcagua, 900 m. alt. Adult ♂, skin and skull, collected by J. Wolffsohn (B.M. no. 1.11.6.2).

Distribution.—Chili, Valparaiso district, west of the Andes, range to the north and south unknown.

Distinguished from typical *pajeros* by the much darker, more varied hue of the upper side, which shows distinct pattern on the back and flanks, and by the invariably ochreous, rusty or brown hue of the pattern on the underside.

The spinal stripe is conspicuous, black and ochreous superficially and emphasized by the silvery grey of the sides, which are clearly marked with the normal obliquely longitudinal brownish stripes. Anteriorly some of these stripes are traceable as narrow lines on the shoulders, nape, and even on the crown, these areas being darker and browner and more finely speckled with clear grey than the flanks. The ears externally are extensively rusty ochreous at the base in well-coloured skins, black to a varying extent at the tip. The stripes on the sides of the face, the area below the ear, and the normal pattern of the underside are ochreous or rusty, rarely brownish. The fore legs are ochreous or buff in front, paler and whitish on the inner side, and the stripes are blackish brown; the hind legs are similarly brightly coloured, but the stripes are mostly rusty brown. The tail above is deep greyish brown, finely speckled with clear grey, not so black and ochreous as the spinal stripe; below it is pale at the base, but gradually darkens towards the tip, and its distal end above and below is marked with broad, transverse, narrowly separated stripes. The pattern on the otherwise white underside is profusely

* The native Chilian name, according to Gay and Wolffsohn, for this cat, which is the handsomest of all the races of *pajeros*.

developed, the normal spots on the belly tending to run into irregular transverse lines, and it is rusty ochreous, rarely brownish.

The seasonal changes are slight. A midsummer skin (December 25) from Hai Llai, 800 m., near Valparaiso, has the hair on the flanks about 40, that of the crest about 70 mm. long, and there is less underwool, and the ochreous areas are a little paler than in a midwinter skin from Cerro de la Campagna, Quillota, 1800 m., Valparaiso, which has the same hairs about 45 and 75 mm. respectively. These skins, like the type and one from Malacara, Quillota, were collected by Wolffsohn. A few undated additional skins are merely labelled Chili.

The following measurements in English inches of two adult ♂♂ show considerable individual differences:—

	Head and body.	Tail.	Hind. foot.	Ear.
Aconcagua (type)	25 $\frac{3}{4}$	11 $\frac{1}{4}$	4 $\frac{1}{4}$	2 $\frac{3}{4}$
Cerro de la Campagna	23 $\frac{1}{2}$	13	5 $\frac{1}{2}$	2 $\frac{3}{4}$

In the first specimen the tail is less than half the head and body, in the second it is considerably more, and the latter has the foot a good deal longer, although the head and body are shorter. Both were measured by Wolffsohn.

There is some evidence that skulls of adult ♂♂ of *huina* may be a little smaller than those of *pajeros*; but they are better developed muscularly, the sagittal crest in the type being complete on the crown from 6 mm. in front of the fronto-parietal suture, rising to 4 $\frac{1}{2}$ mm. on the parietals and to 7 mm. on the occiput. In a younger specimen from Cerro de la Campagna it is 2 $\frac{1}{2}$ on the parietals and 6 on the occiput. The presence of the sagittal crest, complete from a point 4 mm. behind the suture, in the possibly ♀ skull figured by Philippi, is evidence that it came from Chili. In none of the skulls of typical *pajeros* examined is the crest complete, the temporal ridges usually forming a lyrate area. It is narrowest in an old ♂ skull, considerably older than the type of *huina*, from Cap de Tres Puntas, Patagonia (Hull. no. 21.6.7.4). Here the area is only 5 mm. wide from the suture backwards, its edges meeting on the hinder part of the parietals to form a crest 1 mm. high, rising to 5 on the occiput. In three young adult ♂♂ from Cap de Tres Puntas, from Santa Cruz (type of *cruxana*), and from

Rio Gallegos (Allen), the area is lyrate and 10, 17, and 15 mm. wide at the suture respectively. In an adult ♀ from Cap de Tres Puntas the area is 22 mm. wide at that point*.

As regards the possible average difference in size between skulls of typical *pajeros* and *huina*, two adult ♂ skulls of *huina* have the condylobasal and basal lengths varying from 101 and 93 to 95 and 89 mm., those of the type being 97 and 90. In the old ♂ skull of *pajeros* from Cap de Tres Puntas those dimensions are 164 and 97, and Allen's figure of the young adult ♂ skull from Rio Gallegos shows the condylobasal and basal lengths to be 101 and 94 respectively†.

Lynchailurus pajeros budini, subsp. n.

? *Felis pajeros* D'Orbigny and Gervais, Mag. Zool. ser. 2, Mamm. pp. 1-2, 1844 (in part, i. e. northern Argentine specimens with yellower colour and more distinct pattern).

Locality and history of the type.—Mount Sola, 2500 m., in Salta, northern Argentine. Adult ♂, skin and skull, collected by E. Budin (B.M. no. 34.11.4.5).

Distribution.—Known only from the type. Distinguished from typical *pajeros* by the much paler hue of the ground-colour of the upper side including the head and legs, the interspaces between the stripes being buffy whitish, without the tawny or grey tint of *pajeros*; also by the very sharply defined spinal stripe and greater distinctness of the lateral stripes, which are buffy and traceable over the nape and shoulders to the flanks. Even more sharply distinguished from *huina* by its pale upper side, including the head, legs, tail, and pattern, although the pattern is as well defined and extensive; also by the

* In an adult ♀ skull, without skin, from Last Hope Inlet, Chili, to the east of the Andes (Haegert, no. 12.7.12.4), which I provisionally assign to typical *pajeros*, the area is 19 mm. at the suture. This skull is about the same size as the ♀ from Cap de Tres Puntas, their condylobasal lengths being 89 and 88 mm. respectively.

† I have taken the dimensions of this figure because it is stated to be natural size. It does not, however, agree with the text of the volume (Mamm. Patagonia, p. 185, 1905), where the basal length is said to be 98 mm. Allen's measurements of the same skull, published in his 1919 paper (p. 376), agree with neither of these, the condylobasal length being quoted as 96 mm. and the basal as 91.7 mm. The difference in the basal length is too great to be attributable to the "personal equation" of the author.

ears, which are darkish grey at the base, not ochreous, and by the pattern on the underside, including the throat-stripes, being blackish in the middle line, ochreous laterally, and the spots on the belly isolated, not fusing to form transverse lines. The head is drabby grey, the fore legs are pale buffy white in front, with the stripes blackish; the hind legs are nearly cream, with the stripes ochreous externally, black internally and the tail above is almost like the spinal stripe, blackish and buff proximally, but becomes paler and indistinctly striped at the end; below it is white, except quite at the end, where the stripes are visible. The coat in summer (November 27) is about 42 mm. on the back, 73 on the crest.

The flesh-measurements in English inches are:—Head and body $25\frac{1}{2}$; tail $11\frac{1}{8}$; hind foot $5\frac{1}{8}$; ear $1\frac{1}{4}$. The dimensions are about the same as those of the two examples of *huina* cited above.

It seems likely that an example of the Pampas Cat from Puma near Jujuy, which Matschie stated had long spots "like *Colocolo* from Chili," was an example of this race. If so the inference is obvious that at all events in 1894 he thought, like Thomas, that the Chilean race of *pajeros*, described above as *huina*, represented *colocola* of Molina. I cannot ascertain from any of Matschie's papers that he ever apprehended the fundamental differences between the two species.

The skull of the type of *budini* is a little smaller than those of the two ♂♂ of typical *pajeros* mentioned under the last race, the condylobasal and basal lengths being 95 and 87 mm. respectively. The temporal ridges form, as in typical *pajeros*, a lyrate area, which is 14 mm. at the suture; but the bullæ are noticeably less inflated than in *pajeros* and *huina*, the anterior or tympanic chamber especially occupying a relatively smaller area of the bulla.

Lynchailurus pajeros steinbachi, subsp. n.

Locality and history of the type.—Tiraque, Cochabamba, western Bolivia, 4000 m. alt. An adult ♀, skin and skull, collected by Steinbach (B.M. no. 34.9.2.31).

Distribution.—Only known from the type.

Colour above clear ashy-grey with abundance of rich ochreous in the under-hair; pattern consisting of a black and reddish spinal stripe, the red dominant, and of conspicuous rusty-ochreous lateral stripes, which become redder low down on the flanks and dorsally are continued over the grey nape and head as indistinct pale yellowish bands. Ears mostly greyish buff, with the apical fourth of this area black. Fore legs in front buffy, behind white to the wrist, buff below it, the stripes rusty black outside, blacker inside; hind legs much richer, ochreous in front and behind, the stripes rusty black. Tail grey above, with indistinct ochreous bands, mainly buffy below, becoming greyer and striped at the end. Cheek-stripes rufous; throat-stripes mixed ochreous and black, the anterior very broad and joined mesially to the posterior. Spots on the belly blackish brown. Coat in late winter (August 19) shortish, the hairs about 35 mm. on the back, 67 on the crest.

Flesh-measurements in English inches, according to the label:—Head and body * 30; tail $11\frac{2}{3}$; hind foot $4\frac{3}{8}$; ear $2\frac{1}{2}$.

This skin is distinguished from the type of *budini* by the much darker colour of the upper side, the richer colour of the fronts of the limbs; also by the buffy lower surface of the tail and the ochreous wash on the belly, chest, and throat, the pattern below being rusty brown, not black. It is more ochreous below than typical *pajeros* and has the pattern above, including the spinal stripe, much better defined and more rusty below. In its dorsal colour it approaches the palest skins of *huina*, but has less black and is not so silvery grey; the pattern of the ventral surface is not so uniformly rusty red, and the lower parts of the ear behind is grey, not ochreous or rusty.

The skull with a condylobasal and basal length of 88 and 80 mm. is about the same length as that of the adult ♀ of typical *pajeros* from Cap de Tres Pantas and *pm*⁴ is 11 mm. as nearly as may be in both; but it differs in having the bulla much less inflated, 9 instead of 12 mm. high, and 19 instead of 22 mm. long.

* This measurement must be wrong. It is entered on the label as 750 mm. This is probably a mistake for 650, which is about the length of the types of *budini* and of *huina*.

Lynchailurus pajeros garleppi Matschie.

Felis (Lynchailurus) pajeros garleppi Matschie, S.B. Ges. nat. Fr. Berlin, 1912, no. 4, p. 259.

? *Felis pajeros thomasi* Lonnberg, Ark. Zool. viii. no. 16, p. 7, pl. i. 1913.

Locality of the type of *garleppi*:—Cuzco, Peru; of *thomasi*: Quito in Ecuador.

Distribution.—According to the suggested synonymy, Peru and Ecuador.

Three Peruvian skins in the British Museum, probably representing *garleppi*, as Thomas surmised, and a topotype of *thomasi* from Ecuador differ from the type of *steinbachi* in having the interspaces of the upper side more silvery grey, and the lateral stripes not so bright and uniformly rusty ochreous but darker owing to a mixture of brown, which being marginal and surrounding paler centres gives the spots, when isolated, a rosette-like and the stripes a bicolor appearance. There is also no such extensively bright ochreous in the under hair of the dorsal pattern, and the lower side is white, not pale buff, with the pattern blacker. The skulls of these two claimed northern races are, moreover, smaller.

An adult ♀ from Huariaca in Junin, 9000 ft., in Peru to the north of Cuzco (*R. W. Hendee*; B.M. no. 27.11.1.67) has the coat (October 19) long and full, 35 mm. on the sides of the back and 70 on the crest. The interspaces on the sides are clear, rather silvery grey, which sets off the ochreous- and black-tipped spinal crest and the bold lateral pattern of large spots and stripes coloured as described above; the nape is speckled ochreous and grey, with no trace of pattern; the head is a little paler, and the face and cheeks grey; the ear behind is largely black with a grey patch, and darker duller grey at the base; the cheek-stripes and throat-stripes are mostly blackish, the main throat stripe broad, much broader than the one behind it, legs externally buffy grey, their stripes, like the pattern below, mostly blackish, the rest of the underside and the inner surfaces of the legs white; tail closely matching the flanks in general colour above, its stripes ill defined, even at the end.

A younger ♂ specimen, with the same history (no. 27.11.1.66), October 26, is very like the last with the

crest-hairs 65 mm., those at the sides of the back 40, but the pattern is less bold and more confused, and the stripes at the end of the tail are blacker and better defined.

An adult ♂ from Condechaca, Rio Utcubamba, 7000 ft., N. Peru (*R. W. Hendee*, B.M. no. 26.5.3.6), has the coat (November 20). considerably shorter than in the skins from Huariaca, the hairs of the crest being about 45 mm., those on the upper flank 25 mm.; also the general colour of the black pigmented areas above is rather darker, there being no grey on the face, and the margins of the upper spots and stripes are rather deeper brown; this pattern, moreover, is bolder and more conspicuous, consisting of larger spots and stripes than in the adult ♀ from Huariaca; the fronts of the legs are richer and more buffy, and the stripes on the tail are better defined and darker throughout.

Although this specimen was killed only a month later than those from Huariaca, it seems to me that the differences between them in coat and colour may be purely seasonal.

The skin from Condechaca, which has no skull, was not measured in the flesh; but the flesh-measurements in English inches of the adult and young from Huariaca are as follows, those of the immature specimen being put in brackets:—Head and body $20\frac{1}{2}$ (16); tail $11\frac{1}{2}$ ($9\frac{1}{2}$); hind foot $4\frac{1}{2}$ ($4\frac{2}{5}$); ear 2 (2).

The topotype of *thomasi* is a young ♂ from the north-east side of Pichincha, 12,000 ft. (*Söderström*, B.M. no. 24.4.18.5). Except that it has the dorsal interspaces a little duller, more ashy grey, and the main throat-stripe narrower, this skin is inseparable from the Peruvian series. The coat (February 16) is short, as in the skin from Condechaca; the pattern is not so bold as in the latter and as in the adult ♀ from Huariaca, the spots and stripes being smaller like those of the younger Huariaca skin; the face is not so grey as in the Huariaca skins, but darker almost as in the Condechaca skin, and the paws are a shade paler than in the Huariaca skins, almost "whitish grey," as in the type of *garleppi*.

Lönnberg's coloured figure of the type of *thomasi* has the interspaces of the upper side duller, darker grey than in my Peruvian skins; but the pattern is bold and

strongly pronounced, closely matching that of the adult skins from Condechaca and Huariaca. In his comparison of his type with that of *garleppi*, which he examined, Lönnberg made no reference to any difference in the tint of the interspaces, but declared the black spots on the lower side and the stripes on the hind legs to be less conspicuous in *garleppi* and the reddish spots on the sides of the body smaller and more continuous. My topotype of *thomasi*, however, differs in this last feature in precisely the same way from the two adult Peruvian skins, showing the character to have no systematic value. He also stated that the longitudinal bands on the fore quarters are less defined in *garleppi*; but they are quite as well defined in the topotype of *thomasi* as in the Peruvian skins. The only difference he points out that holds good is the narrower throat stripe in *thomasi*; but in the large series of skins of *L. pajeros huina* there is a good deal of variation in the extent of the throat-stripes. Hence so far as the external features are concerned the differences between the Ecuadorean and Peruvian skins may well fall within the limits of individual variation.

In support of his belief that his Quito specimen is racially distinct from *garleppi*, Lönnberg cited some differences in the skulls of the types. That of *garleppi*, unsexed, is a little bigger in all its dimensions than that of the adult ♂ of *thomasi*, the basal length of the latter being 76 mm. and pm^4 only 10 mm. long, whereas in *garleppi* the same dimensions are 78.3 and 12 mm. If the latter was a ♂ and the former, as is possible, a ♀, the differences may well be merely sexual*. The adult ♀ skull from Huariaca has a basal length of 76 mm., exactly the same as in the type of *thomasi*, and pm^4 is 11 mm. and it is 11, or nearly as may be, in the immature ♂ skull from the same locality, and in the immature ♂ topotype of *thomasi*.

The available data justify the suggestion that the Ecuadorean and Peruvian Pampas cats represent the same local race.

* The basal length and pm^4 in an adult ♂ and ♀ of typical *pajeros* from Cap de Tres Puntas are as follows, the ♀ figures being put in brackets: basal length 97 (81), pm^2 14 (11½). A young ♀ from Rio Senguer has pm^2 only 10 mm., attesting considerable individual variation in the size of this tooth.

Lynchailurus pajeros braccatus Cope.*Felis braccata* Cope, Amer. Nat. xxiii. pp. 144-146, 1889.*Lynchailurus pajeros braccatus* J. A. Allen, Bull. Amer. Mus. Nat. Hist. xli. p. 376, pls. xxx. and xxxi. 1919.

Locality of the type and only known specimen, an adult ♂.—Chapada, Matto Grosso, Brazil.

Distinguished essentially from the previously recorded races of the species by the lower part of the legs being noticeably darker than the body, with the feet blackish.

This cat is known to me only from the bibliography. Its status as a local race of *L. pajeros* was established by J. A. Allen, and the diagnosis given above is taken from his paper. He described the colour as somewhat darker, and the pattern as more distinct than in typical *pajeros*; but since he only had a single light tinted skin of *pajeros* from Rio Gallegos, wherewith to compare the type of *braccatus*, and since the pattern is less well emphasized in *pajeros* than in the other races, it is not possible to decide from the data how the general colour and pattern of *braccatus* differ from those of *garleppi* and *steinbachi*. The adult ♂ skull with a condylobasal and a basal length, according to Allen, of 89.3 and 82 mm. respectively, is smaller than adult ♂ skulls of *budini*, *huina*, and *pajeros*, and is about the same size as adult ♀ skulls of the last two and of *steinbachi*. It is distinctly larger than the alleged adult ♂ skull of the type of *thomasi*, and a little larger than the unsexed skull of the type of *garleppi*, with the upper carnassial (pm^4), $11\frac{1}{2}$ mm. about the same as in the latter and as the average size in *huina*.

Genus COLOCOLO, nov.

Felis (*Lynchailurus*) Matschie, SB. Ges. Nat. Fr. Berlin, 1912, no. 4, p. 259 (in part; not *Lynchailurus* Severtzow).*Oncifelis* J. A. Allen, Bull. Amer. Mus. Nat. Hist. xli. p. 366, 1919 (in part; not *Oncifelis* Severtzow).

Type-species.—*Felis colocola* Molina, as determined by Philippi in 1870 and 1873 * (emended to *colocola*).

Distribution.—From Chili to Bolivia and Matto Grosso.

* The skull of this cat is unknown to me. Its characters given in the diagnosis are taken from Philippi's figure (Arch. Naturg. xxxix. pl. iii. figs. 1-2, 1873). On the same plate are drawn for comparison two figs., 3 and 4, of a skull of *Lynchailurus pajeros*. From Philippi's figure Mivart detected many of the peculiarities of the skull of *colocola*, but missed the remarkable bullæ.

Essentially distinguished from all the hitherto named genera of Felidæ by the structure of the auditory bulla, which has its two chambers superficially sharply defined by a deep channel reminiscent of the condition observable in Viverridæ and Herpestidæ, the anterior or tympanic chamber being very large as in *Lynchailurus**. Since the bulla is only shown in profile view nothing else can be said about it, except that it does not project appreciably below the occipital condyle, a point in which it noticeably differs from the bulla of *Lynchailurus*. There are many additional differences between the skulls of these two cats. That of *Colocolo* is much lower, has a bigger orbit, less inflated forehead, and a much longer muzzle, with its upper surface, instead of being abruptly and convexly down-curved, forming an obliquely inclined plane, with the nasal end of the muzzle low and the nasal branch of the premaxilla projecting obliquely upwards and backwards instead of nearly vertically upwards as in *Lynchailurus*. The sides of the muzzle also are noticeably convergent from behind forwards instead of nearly parallel. From this elongation of its facial portion it follows that the postorbital processes are nearly in the middle of the skull instead of well in advance of it as in *Lynchailurus*. The above-described proportions of the skulls of the two species are shown by the following dimensions in mm.

* In a paper on the auditory bulla of the Felidæ (Ann. & Mag. Nat. Hist. (8) xviii. p. 329, 1916) I pointed out this peculiarity in typical *Felis pajeros*; but in a subsequent paper on the classification of existing Felidæ (Ann. & Mag. Nat. Hist. (8) xx. pp. 348-349, 1917) I made two mistakes in nomenclature and specific determination. Unwisely, and without looking into the matter, I accepted Thomas's identification of the Chilian race of *pajeros* as *colocola* and naturally put the two species, as he considered them, into the same genus, for which I took the name *Dendrailurus*, because it has line priority over *Lynchailurus*. The mistake in this respect, as pointed out by J. A. Allen in 1919, was my overlooking Severtzow's citation of *colocolo* Ham. Smith, not of Molina, as the type of *Dendrailurus* Hamilton Smith's Cat renamed *lineata* by Swainson in 1838 and *strigilata* by Wagner in 1841, being, according to the figure and description, entirely different from Molina's and not even, on the evidence closely related to *pajeros*. No cat like it has been recorded since, and for the time being its systematic status must be left in the clouds.

A further error, due to the identification of the Chilian race of *pajeros*, was my denying (Ann. & Mag. Nat. Hist. (8) xx. p. 46, footnote, 1916) the existence of the cranial differences between *pajeros* and *colocola* pointed out by Philippi, and my suggestion that the peculiarities of that author's skull of *colocola* may have been the result of the animal being menagerie-reared. I do not, however, now think that the essential features of the skull were brought about by that factor.

taken from Philippi's figures, which have nearly the same condylo-basal length.

	<i>colocola.</i>	<i>pajeros.</i>
From tip of premaxilla to tip of postorbital process	48	37
From tip of postorbital process to end of occipital crest	54	64
Height of crown from lower edge of bulla ..	41	45
Length of muzzle from tangent to zygomatic arches	22	14
Posterior width of muzzle from same tangent.	33	29
Anterior width of muzzle outside canines ..	24	24

With minor variations in detail these proportions hold good in all the adult skulls of *pajeros* I have seen.

The total length of the skull of *Colocolo* figured by Philippi is 100 mm., only 3 mm. in excess of the condylo-basal length, indicating a poorly developed occipital crest. From this it may be inferred that the skull was not quite full sized. The distance between the temporal ridges, 16 mm. at the suture, would probably have been lessened with increase of age; but probably no complete sagittal crest would have been achieved.

An additional well-marked difference between the skulls of these two cats is found in the nasal bones, which in *Colocolo* are broad, with straight, evenly convergent sides, whereas in *Lynchailurus* the sides are noticeably constricted mesially, the posterior half of the bones being abruptly narrowed, much narrower than the anterior half. In *Lynchailurus* this narrowing of the nasals is accompanied by a corresponding "pinching in" of the upper part of the maxillæ; and the absence of similar "pinching in" of the muzzle in *Colocolo* is a justifiable inference.

It is needless to discuss J. A. Allen's reference of *colocola* to *Oncifelis*, because the skull differs from that of *geoffroyi* in the same characters, more or less as well defined, as those that distinguish it from *Lynchailurus*, with the additional difference that the bulla is even more distinct, that of *geoffroyi* having a smaller outer or tympanic chamber than of *Lynchailurus*.

There are also well-marked, though perhaps less important, external differences between the two genera.

Colocolo has no spinal crest between the shoulders and the root of the tail, the ears are rounded at the tip, instead of narrowed and subangular, and the pattern is very different, the large spots tending to run into vertical bands on the sides and forming very definite transverse stripes on the upper side of the loins *. No other American cat has a pattern anything like it. It is quite different from that of *Oncifelis*, represented by *geoffroyi* and *guigna*, which it resembles, as it resembles the Ocelots, Margays, etc., in the roundness of the ears and the absence of spinal crest.

Colocolo colocola Molina.

From the three skins of this cat in the British Museum I am quite unable to decide if Matschie was right or not in admitting three races. Their tolerably wide geographical separation suggests that his view may have been correct. Their original names and principal references are as follows :—

Felis colocola Molina, Sagg. Stor. nat. Chili, pp. 295 and 341, 1782; Philippi, Arch. Nat. xxxvi. pt. i. pp. 43–45, pl. i. 1870, and xxxix. pp. 11–14, pl. iii. 1878. Type-locality: the forests of Chili according to Molina; but J. A. Allen in 1919 selected Santiago, whence Philippi's example came.

Felis jacobita Cornalia, Mém. Soc. Ital. Sci. Nat. i. pp. 1–9, pl. 1865; Matschie, SB. Ges. nat. Fr. Berlin, 1912, pt. iv. p. 258 (cited as a synonym of *colocola* by J. A. Allen, 1919). Type-locality: Bolivia, between Potosi in that country and Humacuaca in the Argentine. Found in the high mountains.

Felis (Lynchailurus) colocola neumeyeri Matschie, SB. Ges. nat. Fr. Berlin, 1912, no. 4, p. 259. Type-locality: Rio das Mortes, Matto Grosso.

The figure published by Philippi in 1870 is a caricature. It shows, however, broad vertical stripes on the body and eight evenly and widely-spaced stripes extending from the base to the tip of the tail. Cornalia's figure of *jacobita* is better, the general pattern being similar to that of my skins, but the tail has nine rings nearly like those of Philippi's figure. There is a fairly good coloured figure in Lydekker's "Cats" etc. Lloyd's Nat. Hist. pl. xxi.

* I am quite unable to understand Matschie's opinion in 1894 that the differences between *colocola* and *pajeros* are equivalent to the differences between *geoffroyi* and *guigna*, unless at the time he thought the Chilian *pajeros* was *colocola*.

1896 *. In this, too, the tail-stripes, 10 in number, are narrow, widely spaced sharply defined rings. Stress has been laid on the stripes on the tail because Matschie used the difference of one in their number as a character for distinguishing *jacobita* from *colocola* and because in the three figures quoted they are unlike those of the three skins I have seen †.

In general coloration and coat these specimens are reminiscent of the Snow-Leopard (*Uncia*), suggesting rocky hills, not jungle or forest, as their habitat. The coat is very full and soft, about 40 mm. long on the back and 35 mm. on the uniformly bushy tail. The ground-colour above is ashy-grey, darker, owing to black speckling, on the head, nape and back, becoming gradually paler on the flanks and limbs and passing into white on the underside and inner surface of the limbs; the lips, cheeks, chin, and throat are also white; the ears are dark ashy grey, with the extreme edge a little darker. On the head there is a pattern of four indistinct, darkish stripes: two similar stripes are traceable in the middle of the nape, but outside these there is on each side a conspicuous, broadish stripe running outwards towards the shoulder, blackish in front, turning tan behind; on the body from the shoulders backwards the pattern consists mainly of large blotches, brown resulting from a mixture of tan and black on the back, clearer tan on the sides, and transversely elongated, so that when arranged end to end on the sides they simulate broad vertical stripes; on the

* In the text (p. 177) quite a distinct species, namely *Felis colocolo* Ham. Smith, is described under the name *colocolo*. Naturally the figure and description do not agree. The figure was probably adapted from the plate in Elliot's Monograph, which is stated to have been taken from Cornalia's type of *jacobita*. Elliot labelled this plate *Felis colocola*, but in the Museum copy of this work *jacobita* is written over the legend in Thomas's handwriting. Moreover, on Elliot's plate of *F. pajeros* Thomas wrote *colocolo* against the figure in the foreground, apparently representing the Chilian race of *pajeros*.

† Two of them (nos. 23.11.18.1-2) were presented by Ernest Poland, the wholesale furrier, and have no locality. The third (no. 40.851), also apparently a fur-trade skin, because like the others it has no skull, was presented by Rowland Ward and labelled Bolivia. This locality, however, may have been given to it because it was identified as *jacobita*, the type of which came from Bolivia. They were all named *jacobita* because of Thomas's identification of the Chilian race of *pajeros* as *colocola* (see p. 272).

summit of the loins the stripes are more definite, narrower and blacker; on the legs the stripes are mainly blackish, but are redder on the inside of the hind legs; the tail is mostly buffy white above but white at the tip and below, its stripes are roughly nine in number and broad, but their spacing, width, and shape are irregular, some of them being partially subdivided and none of them like the narrow, precise annuli depicted in the figures; the two cheek-stripes and the throat-stripes are rusty-blackish, and the spots on the belly are tan laterally, darker mesially.

XVI.—*Stray Notes on Mallophaga.*

By G. H. E. HOPKINS, M.A. *

15. *Notes on the Types of the Mallophaga described by Bedford.*

After the death of my friend the late Mr. G. A. H. Bedford, the authorities of the Veterinary Laboratories at Onderstepoort found that a considerable portion of his very valuable collection of *Mallophaga* was incompletely labelled, and placed it in my hands so that I might remedy this to some extent.

The collection consists of a large number of specimens, very excellently mounted in Canada balsam, each specimen on a separate slide. The only exceptions to this rule are specimens received from other collections, and a very few pairs mounted *in copula*. None of Bedford's own specimens are stained. The series of each species is usually very short, normally only two males and two females, but this is varied by the retention of similar series collected from different hosts, and there are a certain number of exceptions to the rule, though these are sufficiently few to indicate that the extra specimens were regarded as duplicates. The collection is contained in slide-boxes of the rack-type, and was in a certain amount of confusion, partly owing to additions subsequent to the original arrangement of the collection and partly to the fact that specimens of one species were often in separate boxes, possibly some put aside as duplicates.

* Published by permission of the Director of Medical Services, Uganda.

The labels are of three principal types which are of some importance to the understanding of the following notes. The oldest type of label is one inch wide, and nine-tenths of an inch deep, and has the printed heading "Veterinary Research Laboratory." Later labels are square, with sides four-fifths of an inch long, and the principal differences are that Bedford sometimes used two of these (writing the data on the left-hand label, and the particulars of the parasite on the right-hand one), and sometimes wrote both the data and the name on one label; these are called "double" and "single" labels, respectively, in the notes below. Yet another kind of label, of little importance, was in use for a very short period during the last year of Mr. Bedford's life; it is narrower than deep, coarsely rouletted on both sides, and was apparently used chiefly, if not entirely, for duplicates. Special "type" labels will be mentioned later.

Besides the labelled slides there are a few slides with no labels whatsoever. Their presence is accounted for by Bedford's practice of putting a temporary label loose against a slide or between two slides; some of these temporary labels have been lost and in other instances they had become displaced, but in some cases I was able to attribute them with complete certainty to the specimens to which they belonged, and to write permanent labels for these.

The types and paratypes are frequently not indicated in any way, more particularly in the case of the earlier-described species. It has, therefore, been necessary for me to select lectotypes in many cases. Comparatively recently Bedford obtained a supply of special labels for types and paratypes from Mr. G. B. Thompson, and these were employed for the types of species described during the last few years, with the exception of the *Amblycera* and a few of the Trichodectidæ described in his two posthumous papers, which were only labelled with the data, and had no generic or specific names. Bedford had begun relabelling his types and paratypes with the special labels (the allotypes invariably called "cotype"), and the relabelling of the Trichodectidæ *s. l.* was almost complete, but hardly any of the types in other groups had been dealt with.

I have been guided in my selection of types by the fact that Bedford nearly always published the sex of his holotype, by the data, by a careful comparison of the specimens with the description and figures, and (as the last resource) by the kind of labels. The importance of the labels is that it is clear from examination of the collection that Bedford normally used the square double labels for the specimens to which he attached most importance, though the rule is not quite invariable. Not all the specimens labelled by me are lectotypes, for in a number of cases a species was described from a single specimen or a pair, and in such cases the specimens are definitely holotypes or allotypes, even though Bedford did not so label them. I have not used the term lectotype in labelling the slides, but it is easy to tell from the following notes in which cases it is appropriate. Similarly, Bedford recorded in a number of instances that the types were in the South African Museum, and Dr. A. J. Hesse of that museum kindly went into the matter for me. In many cases he found that the museum possessed a single specimen or a pair from the original lot, though they were not indicated as types. In view of Bedford's published statements these specimens are unquestionably the types; Dr. Hesse has labelled them as such, and I have labelled specimens from the type lots in the Bedford collection as paratypes. In a few instances the specimens in the museum did not even bear the specific name, and Dr. Hesse kindly sent me such specimens to examine.

In view of the fact that some types are legitimately absent from the collection my selection in some cases must be regarded as provisional. Although I have made many enquiries as to the whereabouts of the types of the species described by Bedford, it may yet happen that others will turn up, and the specimens I have selected will revert to being paratypes. This is especially the case with regard to species of which the type material was supplied by Mr. L. Hill, who has not answered my enquiries. In a few instances I have felt so much doubt as to the identity of the types that I have not felt justified in designating any. I have indicated the holotype and allotype (or lectotypes) by red borders drawn round the label, and the paratypes by yellow borders.

A further point which seems worth recording is that Bedford seems sometimes to have been ill-served by those who identified the hosts from which he obtained his material *, since there are a number of instances of obvious and gross misdeterminations of hosts. One instance will suffice: I found in the collection an undetermined *Philopterus* (s. l.) labelled as from a flamingo. Finding that it was a *Neophilopterus*, I noted that it must have been a straggler, and passed on until I came to the *Esthiopterinae*, where I found a series of a probably undescribed *Ardeicola* with exactly the same data. The *Ardeicola* had a familiar look, and on searching my own collection I was gratified to find specimens agreeing exactly with Bedford's, and from *Ibis ibis*, a bird superficially not altogether unlike a flamingo. This bird is recorded as a somewhat uncommon visitor to South Africa.

In the notes below the species are arranged as nearly as possible in the order of Bedford's "Check-List" (Bedford, 1932 a). Host-names are as given in the original description. I have not usually recorded paratypes unless there was a possible doubt about the identity of the types.

Falcolipeurus africanus Bedford, 1931 b. The two males and two females mentioned in the original description are all in the collection. Although Bedford wrote "Holotype a male," none of the specimens were labelled as types or paratypes. One pair, however, were labelled with the generic and specific names, whereas the others had the data only. Both the fully-labelled specimens bear the date 9. ix. 1919 as well as 5. xii. 1916; the former is possibly the date on which the parasites were collected, as opposed to that on which the host was shot. I consider the fully-labelled male to be the holotype, and the fully-labelled female the allotype.

Falcolipeurus lineatus Bedford, 1931 b. Here, again, all the specimens mentioned in the original description are in the collection, and none are indicated as types, one pair from *Terathopius ecaudatus* and the pair from *Gyps*

* This does not apply, of course, to the numerous species he described from material found on skins in the Transvaal Museum, and in the South African Museum.

coprotheres were fully labelled (the specific name in pencil), and the other pair from *Terathopius* were labelled with the data only. Bedford designated as holotype a male, and as allotype a female, from *Terathopius ecaudatus*, and I consider the fully-labelled specimens to be these types. In describing this species Bedford overlooked the fact that he had in his collection a second pair from *Gyps coprotheres*, collected at the same place and on the same date as the others from this host. These specimens (now, by the generosity of the Director of Veterinary Services, South Africa, in my own collection) are not paratypes, but agree perfectly with the types. I am convinced that *Terathopius ecaudatus* is not the true host of this species (see note 17, below).

Gallipeurus l. lawrensis (Bedford), 1929. No specimens from the type lot are in the collection. The types are in the South African Museum, Capetown, the male being the holotype.

Gallipeurus p. pternistis (Bedford), 1929.—The types were without special labels, but were marked "Holotype" and "Allotype" in Bedford's writing.

Lagopæcus waterstoni (Bedford), 1930.—The types are in the South African Museum, but there are a pair of paratypes (not so labelled) in the collection. The types were labelled only with the data and "*Nov. gen. et sp.*"

Colilipeurus colius (Bedford), 1920 a.—Of the original series there are in the collection a pair *in copulâ*, a male broken into two pieces (but in perfectly useful condition), and another female, all with single labels and none indicated as types or paratypes. The figures were almost certainly drawn from the pair *in copulâ*, especially the male, of which the portions shown dotted in Bedford's figure correspond exactly to the parts somewhat hidden in the specimen. No holotype or allotype has ever been designated. I therefore designate the male of the pair *in copulâ* as the holotype and the female of this pair as the allotype.

Otilipeurus kori Bedford, 1931 b.—This species was described from a single pair, the female being the holotype. Both are in the collection, not indicated as types and with square single labels.

Otidæcus dimorphus Bedford, 1931 b.—There are two pairs from the type lot in the collection, all with square single labels and none indicated as types or paratypes.

Bedford stated his holotype to be a female. There is little to choose between the specimens, and all agree well with the figures, but one pair are slightly better-mounted than the others. The labels of the better-mounted pair have a narrow black edging and are precisely similar to those on the types of *Otilipeurus kori*, whereas the others have rather larger labels without the black border. I consider the female of the better-mounted pair to be the holotype, and the male of this pair the allotype, and have so labelled them.

Goniodes pternistis Bedford, 1929.—Described from "several males and females taken off *Pternistis swainsoni* . . . in the Zoological Gardens, Pretoria, on the 4th November, 1925." No holotype was designated. There is a single pair belonging to the type lot in the collection. They have double square labels, and I think there is little doubt that they are the types. I have labelled the male as holotype and the female as allotype.

Goniodes scleroptilus Bedford, 1929.—Described from two females and one male. There are two females from the type lot in the collection, but one was unnamed, and must have been overlooked when the description was drawn up: it is, therefore, not a paratype. The types are in the South African Museum. No holotype was designated by Bedford, and I designate the male as holotype and the female as allotype.

Coloceras hilli (Bedford), 1920 *a*.—The two females and two males mentioned in the description are all in the collection, all with single labels and none indicated as types. No holotype was designated. One pair has square labels, and the other pair the oldest kind. I have selected the pair with square labels as types (there being no other indication) and the male as holotype.

Naubates harrisoni Bedford, 1930.—Described from three males and one female. Two of the original males are in the collection, and the types are in the South African Museum, the male being the holotype.

Naubates pterodromi Bedford, 1930.—The holotype female is in the South African Museum, and two paratypes in the collection.

Ibidæcus threskiornis Bedford, 1929.—"Described from a number of females and males taken off *Threskiornis æthiopica* . . . at Emakosini, Zululand, on the 29th October, 1924." "Holotype: a female." There are

in the collection one male and one female each labelled "Cotype" in Bedford's writing, and a second pair from the original batch, not so labelled. The pair labelled "Cotype" are evidently the types, and I have labelled the specimens accordingly.

Neophilopterus abdimius Bedford, 1929.—There are in the collection one male and two female paratypes. The types are in the South African Museum, and Bedford designated the female as holotype.

Procavicola angolensis Bedford, 1936.—The types are in the British Museum, and the paratypes in the Bedford collection have special labels.

Procavicola emarginata (Bedford), 1928.—Holotype (sole original specimen) in the collection, with a special label.

Procavicola furca Bedford, 1939 *a*.—The male holotype is present in the collection, specially labelled. The female is unknown.

Procavicola heterohyracis Bedford, 1932 *a*. Holotype and allotype with special labels.

Procavicola jordani Bedford, 1936.—The male holotype and female allotype are in the British Museum collection, and paratypes, with special labels, are in the Bedford collection.

Procavicola lopesi Bedford, 1939 *a*.—This species was described from material belonging to me, and I have presented the types (which had special labels) to the British Museum. There are paratypes in the Bedford collection.

Procavicola mokeetsi Bedford, 1939 *a*.—Types, with special labels, in the collection.

Procavicola natalensis Bedford, 1932 *b*.—Types in the collection, specially labelled.

Procavicola parva Bedford, 1932 *b*.—Holotype male in the collection, specially labelled. Although Bedford writes of "males and females" he did not describe the female, and there are no specimens of this sex in the collection.

Procavicola pretoriensis Bedford, 1932 *b*.—Types present, specially labelled.

Procavicola sternata (Bedford), 1928.—Types present, specially labelled.

Procavicola subparva Bedford, 1932 *b*.—Types, specially labelled, in the collection. Although Bedford writes of

"females" the allotype is the only specimen of this sex in the collection.

Dasyonyx minor Bedford, 1939 a.—The holotype female had a special label. The male is unknown.

Dasyonyx nairobiensis Bedford, 1936. Described from material belonging to me, and holotype and allotype presented to the British Museum. There are paratypes in the collection.

Dasyonyx oculatus Bedford, 1928.—The single male holotype is in the collection, specially labelled.

Dasyonyx ovalis Bedford, 1932 b. Types present, specially labelled.

Dasyonyx transvaalensis Bedford, 1932.—This species was figured and very briefly described by Bedford in 1928 (p. 848, pl. ii. fig. 6), as *Eutrichophilus diacanthus* (Ehrenberg), from a single female collected on *Procavia capensis coombi* at Rooikrans, Transvaal. In August 1932 (1932 a. p. 360) he renamed it *Dasyonyx transvaalensis*, and in September (1932 b. p. 722, fig. 10, 13 b, 14 a) he described and figured both sexes under the new name. The original female is in the collection, but had no indication of its status; I have labelled it "Type." One of the males had a special label "Cotype" (=allotype), but in view of the fact that Bedford's paper 1932 a was published (against his expectation) before his 1932 b, this specimen is, strictly speaking, a neallotype. Similarly, the specimens labelled as paratypes are, strictly speaking, neoparatypes.

Dasyonyx validus Bedford, 1932 b.—This name was a *nomen novum* for "*Trichodectes lindfieldi* Hill" of Ferris, 1930, *nec* Hill 1922. The types are, therefore, the specimens described by Ferris, and were never in the Bedford collection.

Dasyonyx waterbergensis Bedford, 1932 b.—Types present, specially labelled.

Dasyonyx windhuki Bedford, 1936.—"Holotype, a male, and allotype . . . will be deposited in the British Museum collection." There are paratypes in the Bedford collection.

Procaviphilus ferrisi Bedford, 1932 b.—This was a *nomen novum* for "*Trichodectes scrraticus* Hill" of Ferris 1930, *nec* Hill, 1922. The types are the specimens described by Ferris, and there are no specimens of the species in the Bedford collection.

Procaviphilus granuloides Bedford, 1939 *a*.—Described from material belonging to me. The types are in the British Museum, and there are paratypes in the Bedford collection.

Procaviphilus robertsi (Bedford), 1928.—Holotype male and neallotype female (latter labelled "Cotype") present and with special labels.

Procaviphilus sclerotis Bedford, 1932 *b*.—Types present, specially labelled.

Bovicola adenota Bedford, 1936.—Described from my material. The types are in the British Museum and paratypes in the Bedford collection.

Bovicola dimorpha Bedford, 1939 *a*.—"The holotype will be deposited in the British Museum collection, and the allotype will be returned to Dr. Liu." The allotype, with two male paratypes, was still in the collection when examined. Miss Clay informs me that the holotype is not in the British Museum.

Bovicola hilli Bedford, 1934.—Types in Mr. Hill's collection. Two female paratypes in the Bedford collection, one specially labelled, the other not indicated as a paratype.

Bovicola martinaglia Bedford, 1936.—The two pairs in the collection are from the type lot, but were not even labelled with the specific name. I have assumed that they are paratypes, but it is very probable that they include the types, which are not in Dr. Martinaglia's possession.

Bovicola pelea Bedford, 1934. Types present, specially labelled.

Bovicola thompsoni Bedford, 1936.—"The holotype will be deposited in the British Museum collection." One female paratype is in the Bedford collection; the male is unknown. Miss Clay tells me that the holotype is not in the British Museum.

Damalinia hopkinsi Bedford, 1936.—The male holotype is in the British Museum, and the only paratype in my collection.

Damalinia theileri Bedford, 1928.—Described from a single female, which is in the collection labelled "Holotype" in Bedford's writing, but not specially labelled. The undescribed male is also represented in the collection.

Eutrichophilus maximus Bedford, 1939 *a*.—The unique

female is in the collection, but was labelled only with the data. I have labelled it as the holotype.

Felicola caffra (Bedford), 1919.—Described from a single pair which are in the collection, but not indicated as the types. Bedford later (1932 c, p. 357) designated the male as holotype, and I have labelled the specimens accordingly.

Felicola calogalea (Bedford), 1928.—Of the type series there were in the collection two pairs from *Calogale cauxi* and two pairs from *C. pulverulentus*. Bedford designated as holotype "the male from *Calogale cauxi*." None of the specimens were labelled as types or paratypes, and there is nothing to indicate which of the specimens from *C. cauxi* are the types; I have selected one of the males from this host as lectotype and a female from the same host as allotype.

Felicola cooleyi (Bedford), 1929.—Types in collection, with special labels.

Felicola cynictis (Bedford), 1928.—Described from "males and females taken off *Cynictis penicillata* . . . at Onderstepoort . . . and at Bothaville, O.F.S." There were in the collection a pair from Onderstepoort and a male and two females from Bothaville. I have selected the better male (from Onderstepoort) as lectotype and the accompanying female as allotype.

Felicola genetta (Bedford), 1919.—Described from "two slightly immature females and one male," the male being subsequently designated as holotype by Bedford (1932 c, p. 363). All three specimens were in the collection, none indicated as types. The male is certainly the holotype, and I have labelled it accordingly; one of the females agrees very well with Bedford's figure and the other does not; I consider the former to be the allotype and the latter the paratype, and have labelled them thus.

Felicola helogale Bedford, 1932 c.—Described from two females and one "immature male"; holotype a female. All the specimens are in the collection, one female with a special holotype label, the other not indicated as belonging to the type series, and the immature specimen with a special paratype label. This specimen is extremely immature, and I can see nothing to indicate that it is a male; the male of this species must, therefore, be considered still unknown. I have labelled the second female as a paratype.

Felicola hopkinsi Bedford, 1936.—The types are in the British Museum.

Felicola rostrata Bedford, 1932 c.—Types in the collection, specially labelled.

Felicola setosa Bedford, 1932 c.—Types in the collection, specially labelled.

Felicola zeylonica Bedford, 1936.—“The holotype, a male, and allotype will be deposited in the British Museum collection.” There are paratypes in the Bedford collection.

Protelicola intermedia Bedford, 1932 c.—Described from “Males and females taken off . . . *Proteles cristatus* (Sparrm.), Umkomaas Valley, Natal, 19. vi. 1931 (coll. L. Hill). Holotype a male.” The collection contains one male, two females, and an immature specimen from the type series. These are either types or paratypes, but in view of the probability that the types are in Mr. Hill's collection, and my failure to ascertain whether this is indeed the case, I have not dared to label the specimens in the Bedford collection.

Trichodectes ovalis Bedford, 1928.—Although this was described from “females and males collected by the writer off *Pæcilogale albinucha* . . . at Onderstepoort on the 1st March, 1920,” there is only one pair with the correct data in the collection. Bedford designated a female as holotype, and I have so labelled the female of the above pair; I have labelled the male “Allotype.” A second male has similar data except that the date is merely “1920”; I consider it to be a paratype, and have so labelled it. It is worth recording that Bedford later thought that he had misidentified the host, and that it was really *Ictonyx striatus*.

Trichodectes ugandensis Bedford, 1936.—This species was described from material belonging to the British Museum. The types are in the British Museum, and the single female paratype in my own collection.

Tricholipeurus æpycerus Bedford, 1929. Described from a single pair, the male being the holotype. The types are in the South African Museum, and the species is not represented in the Bedford collection.

Tricholipeurus antidorcus Bedford, 1931 b.—“Described from males and females taken by the writer off *Antidorcus marsupialis* . . . at Onderstepoort on the 25th

July, 1930." "Holotype a male." There are two pairs with the correct data in the collection, but none are labelled as types or paratypes. One pair have neater labels than the others and are slightly the better specimens; I have labelled the male of this pair as holotype, and the female as allotype. The others are paratypes.

Tricholipeurus elongatus Bedford, 1934.—The types are in the collection, specially labelled.

Tricholipeurus lerouxi Bedford, 1930.—This was described from two females, of which one was labelled with a special holotype label. The paratype was missing, but I found a second female among some completely unlabelled slides which appeared to have been set aside as rubbish. In view of the absence of labels of any kind I cannot regard this as the missing paratype, but it agrees in every detail with the type and must, I think, be from the type lot. I have been most generously permitted to retain this second specimen.

Tricholipeurus lineatus (Bedford), 1920 a.—The types are in the collection, specially labelled.

Tricholipeurus reduncæ Bedford, 1929.—Types present, specially labelled.

Tricholipeurus trabeculæ Bedford, 1929.—Types present, specially labelled.

Tetrophthalmus africanus Bedford, 1931 a.—In the paper in which Bedford described this and the next two species he did not record the amount of material from which the species were described, but he stated (p. 242) that all the holotypes were females. Of the type lot of the present species there are in the collection two males, two females, and three immature specimens. All have single labels, but one pair have neater labels than the others, and the same specimens agree best with Bedford's figures. I consider them to be the types, and have so labelled them; the other adults are paratypes.

Tetrophthalmus australis Bedford, 1931 a.—The same remarks apply to the two pairs of this species in the collection. I have labelled the pair best in agreement with the figures (and neatest labelled) as types, and the other pair as paratypes. As I have not been able to trace the source of the material, it is just possible that the specimens I have labelled types are only paratypes, and that the types are in Australia, but the correspondence

with the figures is sufficiently close* to make this very improbable.

Tetrophthalmus subtitian Bedford, 1931 a.—There are only one male and one female from the type lot in the collection, and I consider them to be the types.

Allomenopon lophocercus (Bedford), 1920 b.—Bedford never designated a type, or even a type-host, for this species. Of the original series there are in the collection a pair from *Lophoceros leucomelas*, a pair from *L. epirhinus*, and two males and a female from *L. erythrorhynchus*. Of these the male from *L. leucomelas* (the first host mentioned by Bedford) agree best with the figure of the male genitalia, and I have selected this as the type and the female from the same host as the allotype.

Pseudomenopon rostratulæ Bedford, 1919.—Of the original series there are two pairs in the collection, one pair with the neatest type of single label, and the other pair with the oldest type of label, on which Bedford had not even written the specific name. Bedford did not mention to which sex the holotype belongs, but he described the female in full, and the male much more briefly. I consider the pair without specific names to be paratypes, and of the neatly labelled pair I have selected the female as type and the male as allotype.

Chapinia africana (Bedford), 1919.—The types were specially labelled, the holotype being a female from Gruut Schoor. The specimens from Mafa, South-West Africa, mentioned in the description are not conspecific.

Machærilæmus plocei Bedford, 1920 a.—The original pair are in the collection, the female labelled "Type" in Bedford's writing, together with another female from the type lot, which he evidently overlooked when he described the species. The male must be the allotype. Although the species was described from "Waxbill" the host on all the labels is *Quelea sanguinirostris lathamii* (A. Sm.).

Machærilæmus urocolius Bedford, 1930.—The original pair from Ntabanana are in the collection, together with the female (but not the male) from Onderstepoort. Bedford designated a female as holotype. The Onderstepoort female was labelled only with host, locality, and date, and I consider it to be a paratype. I have labelled the

* There is a good deal of individual variation in *Tetrophthalmus*.

Ntabanana female and male as holotype and allotype respectively.

Neomenopon pteroclorus Bedford, 1920 *a*.—The holotype female labelled "Type" in Bedford's writing, and one immature paratype are in the collection.

Plegadiphilus threskiornis Bedford, 1939 *b*.—There are two males and two females in the collection, all from the same host-individual of *Threskiornis æthiopica*. Although none of the specimens were labelled with the generic or specific names it was obvious which pair were intended to be the types, because these had separate data-labels, whereas the other pair had single labels with spaces for the insertion of the generic and specific names. I have labelled the former pair as types and the latter as paratypes. Bedford designated a female as holotype.

Menopon francolinus Bedford, 1920 *b*.—"Described from a number of females and males taken off *Francolinus sephæna* in the Rustenburg District, and a few from *Pternistes swainsoni* in the same district." No type or type-host has been designated. Of the type lot there were in the collection two pairs from *F. capensis* and one pair from *P. swainsoni*, one pair from the former host with square single labels, and the rest all with the oldest type of single label. The pair with square single labels are also the best specimens, and I consider them to be the types; as Bedford described the female in full, I have labelled this the holotype and the male the allotype.

Menopon powelli Bedford, 1920 *b*.—The published particulars of the type batch of this species are exactly as for *M. francolinus* except that the numbers on the two hosts are reversed. No type or type-host has been designated. The collection contains two pairs from *P. swainsoni*, and three males and two females from *F. sephæna*; it seems clear from Bedford's description that the former bird was intended to be the type-host. Of the two pairs from this host one is slightly better-mounted than the other, and has the square single label, the other pair having the oldest type. I have labelled the female (the sex figured by Bedford) of the former pair "Holotype" and the male "Allotype." It is perhaps worth noting that all the specimens of the original batch from *F. sephæna* are labelled "Buffelsdraai, Tr.",

and certainly worth mentioning that the two species of hosts were not obtained on the same occasion since this tends to exclude straggling.

Austromenopon africanum var. *transvaalense* (Bedford), 1920 b.—The variety was described from specimens "taken from a domestic duck at Maritzburg," and there are only two specimens, a male and a female, with this data in the collection. Both have the old type of label and were without the specific or varietal names. Bedford never designated a type for this form, but his description deals mainly with the female, so I have selected the female as type and the male as allotype.

Myrsidea hopkinsi Bedford, 1939 b.—This species was described from material belonging to me, and there were a number of specimens of the type lot in the collection, none labelled except with the data. One pair had neater labels than the rest, and were evidently intended as the types—a fact confirmed by their being slightly better mounted than the remainder. Bedford designated a female as holotype, and I have labelled this pair accordingly. The types are in the British Museum, and paratypes in several collections, including Bedford's and my own.

Myrsidea ptilostomi Bedford, 1939 b.—Almost the same remarks apply, but there were two pairs with the neatest type of label. Selection of the holotype female was easy because the sternal plates of the two specimens are differently shaped, and the one which agrees with Bedford's figure is obviously the type, but there was nothing to indicate which of the two males with this type of label is the allotype, and I have merely selected the better of the two specimens. Types in the British Museum, paratypes in several collections, including Bedford's and my own.

Myrsidea subanaspila Bedford, 1939 b.—Although Bedford speaks of "females and males from Onderstepoort," there are only two females and one male from this locality in the collection. None of the specimens bore the specific name, but the male and one of the females had recently been given new data-labels by Bedford, and are obviously the allotype and holotype respectively. The second female is a paratype, but the second male is from Beira, and although I think it conspecific it cannot be a paratype.

Menacanthus corvus Bedford, 1930.—The types were labelled by Bedford (obviously quite recently) with special type-labels bearing the inscription "*Menacanthus gonophæus* (Nitzsch). Syn. *M. corvus* Bedf." The female is labelled "Type" and the male "Cotype" (*i. e.*, allotype).

Menacanthus crateropus (Bedford), 1920 *b.*—"Several females . . . off *Crateropus bicolor* . . . and *Crateropus jardinei* . . . in the Rustenburg District, Transvaal." No type or type-host has been designated, and the collection contains two females from each host, all from the type lot. One female from each host had been relabelled by Bedford with the newer type of single label, whereas the others still retain the oldest type of label. The relabelled specimen from *Crateropus bicolor* agrees better with Bedford's figure than any of the others, and I have chosen it as lectotype.

Eucolpocephalum robustum Bedford, 1930.—Described from three females and two males from *Platalea alba*, Capetown, July, 1923; holotype a female. The types are in the South African Museum, but were labelled only with the data and the genus *Colpocephalum*: there are paratypes in the Bedford collection.

Psittacomenopon poicephalus (Bedford), 1920 *b.*—The original pair are in the collection, labelled "*M. impar* var. *poicephalus* Bedf." on the oldest type of label. The male is perfect, the female is somewhat broken, but with all the parts present, and is in perfectly useful condition. As the females of this genus are more distinctive than the males I designate the female the holotype, no previous designation having been made.

Heleonomus harrisoni (Bedford), 1919.—Although the original description says "described from two females," there are four specimens from the type lot in the collection, of which two are males. One of each sex has the oldest type of label, and is labelled "*C. harrisoni* Bedford," and the other pair have newer labels inscribed "*Heleonomus harrisoni* (Bedf.)." The female with the old-type label has the front of the head distorted, but the relabelled one agrees perfectly with Bedford's figure, and is obviously the holotype. The males must have been overlooked when the species was described.

Aneutalus africanus (Bedford), 1939 *b*.—Of the type series there were two males and two females in the collection, none labelled except with the data. Bedford designated a male as holotype. One pair had separate data-labels and were clearly intended to be the types, the other pair having single labels with spaces for the generic and specific names. The types have been returned to Mr. G. B. Thompson.

Colpocephalum ferrisi Bedford, 1930.—Two of the original males are in the South African Museum, neither of them indicated as type or paratype. One agrees much better than the other with Bedford's figure, and I have labelled the former "Holotype."

Colpocephalum subzebra Bedford, 1939 *b*.—There is in the collection a single male from *Anastomus lamelligerus*, and it is evident that this is the holotype; Bedford obviously chose this bird as type-host because the single specimen was in his own collection. The allotype is presumably in the Congo Belge Museum, and I assume that the female in the Bedford collection is a paratype, and a second male certainly is, but I have only labelled the latter. It is to be noted that the type is not (as would be inferred from Bedford's remarks) from Congo Belge, but from Rustenburg District, Transvaal, 5th February 1917; the data given in the paper refer to the allotype and paratypes.

Eulæmobothrion kelloggi (Bedford), 1919.—This was a *nomen novum* for *Læmobothrion setigerum* var. *africanum* Kellogg and Ferris, 1915, nec *L. africanum* Kellogg, 1910. The types are, therefore, the specimens described by Kellogg and Ferris, and were never in the Bedford collection.

16. *The Hosts of some Species described from Hyracoidea.*

As has been pointed out by Bedford (1932 *b*, p. 709) the Hyracoidea are a very archaic group of mammals, and their systematics are peculiarly difficult owing to the fact that differentiation within the group has apparently been very much retarded. We accordingly find in this group the anomaly of parasites which have apparently outstripped their hosts in specific differentiation,

and the proper determination of the hosts of parasites described from hyraxes is of even greater importance than usual. Bedford, noting this anomaly, very wisely usually gave the Transvaal Museum numbers of the individual hosts from which he collected new species of Mallophaga, and in a number of instances these have now been more accurately determined. Through the kindness of Dr. Austin Roberts of the Transvaal Museum I am able to list below the specimens for which more accurate determination are now available.

Dr. Roberts was unable to assist with regard to the form or forms collected at Mtabamhlope, Natal, by P. Barnes, from which Hill described *Procavicola lindfieldi* and *Procaviphilus serraticus*, and Bedford described *Procavicola sternata*; the presence of two species of *Procavicola* does not indicate that two species or subspecies of hosts were concerned, since it is not unusual for two species of this genus to occur on one host, and the fact that the host of Hill's two species is given as *Procavia capensis*, and that of *Procavicola sternata* as *P. capensis natalensis* Roberts, is not evidence in this respect, because all South African hyraxes of this group were formerly referred to *capensis*.

Hill does not give the date on which the host was collected, but paratypes of both Hill's species are in the Bedford collection, and the date is the same as that on which the host of *P. sternata* was obtained. Furthermore, Hill writes of "a Cape Hyrax," implying that there was only one individual. On the whole it seems probable that only one host (probably one individual) was concerned, and that Bedford's species was described from the unmounted residue of the material in Mr. Hill's possession.

In view of the locality, and the fact that Bedford later collected both of Hill's species on *P. c. natalensis*, I suggest that it is extremely probable that the original host of *Procavicola lindfieldi* (Hill), *P. sternata* (Bedford), and *Procaviphilus serraticus* (Hill) was *Procavia capensis natalensis* Roberts. The fact that *Procavicola natalensis* Bedford was also described from this host militates against my suggestion; possibly the host of the latter was misidentified.

The remaining hosts as to the identity of which Bedford expressed doubt are listed below, together with their present status; all were originally determined as *Procavia capensis* or *Procavia* sp.

- T.M. no. 4324. Near to *P. capensis orangiz* Rbts.
 T.M. no. 3275. *P. capensis letabæ* Rbts. (Paratype.)
 T.M. no. 2148. *P. capensis ? capensis* (Pallas).
 T.M. no. 4861. *P. capensis chiversi* Rbts. (Holotype)

The doubt as to the identity of no. 2148 is due to the absence in South African museums of topotypical material for comparison. From no. 4234* Bedford described *Procavicola furca* and *Dasyonyx minor*, from no. 3275 *Procavicola mokeetsi*, from no. 2148 *Procavicola parva*, and from no. 4861 *Procavicola subparva*.

It seems not beyond the bounds of possibility that the best method for the determination of specimens of Hyracoidea (especially juveniles) may be found to be an examination of their Mallophagan parasites.

17. *The Hosts of the Species of Falcolipeurus described by Bedford.*

Bedford (1931, p. 291) described two new species of *Falcolipeurus*, *F. africanus* ostensibly from *Pseudogyps africanus fulleborni* and *F. lineatus* ostensibly from *Terathopius ecaudatus* and *Gyps coprotheres*. While working on the Bedford collection I took the opportunity to compare many of my specimens with his types, and was amazed to find that all my specimens of *Falcolipeurus* from *Pseudogyps africanus* were *F. lineatus* Bedford, not *F. africanus* Bedf. as I had expected. As *Gyps* and *Pseudogyps* are rather easily confused I assumed that I must have misidentified my birds, but Colonel Meinertzhagen kindly lent me a long series of *Falcolipeurus* collected by himself on *Pseudogyps africanus* in East Africa, and these are also *F. lineatus*. We may take it as certain, therefore, that the host from which Bedford's specimens of *F. lineatus* came was misidentified, and was really *Pseudogyps africanus* (or the subspecies *fulleborni* if it be considered recognizable).

* The Tol. Mus. number given in Bedford's paper is 1324, but this was a slip.

But what is the host of *Falcolipeurus africanus*? Since *Pseudogyps africanus* bears *F. lineatus*, and both Colonel Meinertzhagen and myself have failed to find *F. africanus* on it after searching many individuals, it is most improbable that the host of Bedford's specimens was correctly determined. Among the principal specific characters in *Falcolipeurus* are the shape of the head and (in the male) the shape and chaetotaxy of the elongated lateral plates on sternites 8 and 9, and especially the number of incrassations (in some aspects appearing as definite serrations of the outer wall) on these plates. In *F. lineatus* there are four or five such incrassations, *F. africanus* has only one, and in some species there are none. I possess specimens of *Falcolipeurus* from *Necrosyrtes monachus pileatus* and *Aegyptius monachus*, and Col. Meinertzhagen kindly lent me numerous specimens from *Gyps fulvus* and *Neophron p. percnopterus*, and a single female from *Torgos tracheliotus nubicus*. Careful comparison of the types of *F. africanus* with these specimens shows that this species is not identical with any of them, but it seems nearest to the material from *G. fulvus*. This material agrees rather closely in shape of head with *africanus*, and the sternal plates of the male show only one rather indefinite incrassation, but the shape of the plates and the chaetotaxy of this region are different, and the two forms cannot be conspecific.

The evidence is inconclusive, but suggests that the true host of *Falcolipeurus africanus* was a *Gyps*, possibly *G. coprotheres*. Unfortunately, I have not been able to examine any material from this host.

18. *The Date of Publication of Bedford's two Posthumous Papers.*

On receiving separates of Mr. Bedford's two posthumous papers, published in Vol 12 of the 'Onderstepoort Journal of Veterinary Science and Animal Industry,' I was surprised to find that they bore the date January, 1939. As I knew that they had not been published at that time I wrote to Mr. R. du Toit of Onderstepoort, and asked him what was the actual date of publication; he informs me that it was 14th November, 1939.

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XVII.—*Nyasa Fishes of the Genus Tilapia and a new Species from Portuguese East Africa.* By ETHELWYNN TREWAVAS, D.Sc., British Museum (Natural History).

IN his paper on the Cichlidæ of Lake Nyasa Regan (1921) briefly listed four species of the genus *Tilapia*, *T. melanopleura*, *T. mossambica*, *T. shirana*, and *T. squamipinnis*. The record of *T. mossambica* was based on Boulenger's determination of a fish from the Upper Shiré, which is, in fact, a large male of *T. shirana*; it has the outer teeth bicuspid, not simple as in large males of *T. mossambica*, as well as having the four anal spines characteristic of *T. shirana*. No specimen of *T. mossambica* is known from Nyasa, unless a small fish in the Christy collection, described below, belongs to that species.

In my "Synopsis of the Cichlid fishes of Lake Nyasa" (1935) I referred to Regan's list and left the *Tilapia* species for later study. The *Tilapias* of the Christy collection were then sorted under four names, with *T. mossambica* queried. In 1939 (January to June) I had the opportunity

of taking part in a fishery survey * of this lake, the other members of the expedition being Miss C. K. Ricardo and Mr. H. J. H. Borley, who collaborated in obtaining the field information on which this paper is largely based.

As a result of the Survey three more names must be added to the list of Nyasa species of *Tilapia*, which now reads :—

Tilapia melanopleura Duméril.

T. sparrmani A. Smith.

† *T. mossambica* Peters.

T. shirana Boulenger.

T. squamipinnis (Günther).

T. lidole, sp. n.

T. karongæ, sp. n.

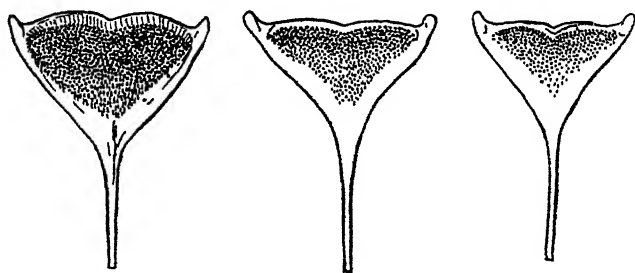
As in Lake Victoria, so in Lake Nyasa the species of *Tilapia* include the most important food-fishes. They are caught in large numbers, and there is evidence that true shoaling occurs, at least in *T. squamipinnis* and *T. shirana*. Observations on bionomics and life-history are being published in the Report of the Survey submitted to the Colonial Office. Only diagnoses and brief notes bearing on taxonomy are given here.

Tilapia squamipinnis, *Tilapia lidole*. and
Tilapia karongæ.

It was found that the fishermen at Kota Kota and at the south end of the lake recognized at least two species that answered to the description of *T. squamipinnis*. The natives have separate names for the growth stages, sexes, and phases of the sexual cycle in *T. squamipinnis*, and the more intelligent know to a great extent what the names signify. In addition they insisted that the fish named Lolo (plural Malolo) at Kota Kota and Lidole (plural Madole) at the south end of the lake was not a kind of Chambo (i. e. *T. squamipinnis*), and it was found that this was indeed a distinct species; it is here named *T. lidole*. On returning to London, I examined the "*Tilapia squamipinnis*" of the British Museum collection, and found that they included not only *T. squamipinnis*

* Under the auspices of the Colonial Development Commission and of the British Museum (Natural History).

and *T. lidole*, but also a third species, named below *T. karongæ*. All the specimens of *T. karongæ* (except one without details) were collected by Christy at the north end of the lake, to which our expedition paid only a short visit, and in the months of August to October, of which we had no experience. The possibility remains that some of the *Tilapia* seen in the north by the expedition were *T. karongæ*. It is alternatively possible that *T. karongæ* is not seen inshore except in the breeding season, and that all the specimens put down by the expedition as *T. squamipinnis* were rightly identified. The fishes collected by Christy in the north include specimens of all three species.



Lower pharyngeal bones of, left, *T. karongæ*; middle, *T. squamipinnis*; right, *T. lidole*; each from a fish of 29 cm. total length. $\frac{2}{3}$ natural size. The teeth are more numerous than the dots representing them.

T. lidole is easily distinguished from *T. squamipinnis* at a length of 29 cm. or more, but no specimen of less than 28 cm. was distinguished by the members of the expedition as *lidole*. On one occasion a few specimens of less than 28 cm. were so named by natives, but they were not seen by me, and their identification was not checked. It seems probable that the natives themselves do not usually distinguish the two species below 26 to 28 cm. Of *T. karongæ*, on the other hand, the largest known specimen measures 29.5 cm. (250+45 mm.). Two sets of diagnoses are given therefore, one in which large specimens of *T. squamipinnis* and *T. lidole* are contrasted with each other, and one in which smaller specimens of *T. squamipinnis* and *T. lidole*, on the one hand,

are contrasted with *T. karongæ* on the other. All the specimens on which the diagnoses are based are in the British Museum (Natural History).

Tilapia squamipinnis (eleven specimens of 29 to 34 cm.).

Arch of back usually highest behind the first dorsal spine. Depth of body contained 2.3 to 2.6 times in the standard length. Length of head 2.7 to 3.1 times in the standard length. Length of lower jaw 2.7 to 3.1 times in the length of head. Sides of toothed area of lower pharyngeal bone slightly concave; median length of bone 1.2 to 1.3 times its greatest width. Scaly coating of caudal fin dense enough to obscure outline of rays.

Males found inshore December to June, and probably whole year; breeding males with top of head and back turquoise. Young sheltered in mouth of mother only until they reach a length of about 15 mm. Females sheltering young found in reed beds, and especially in estuaries and inlets. Main breeding season October to January, extending into February.

Tilapia lidole (nine specimens of 29 to 34 cm. total length).

Arch of back usually highest in front of dorsal fin. Depth of body contained 2.5 to 2.8 times in the standard length. Length of head 2.6 to a little less than three times in the standard length. Length of lower jaw 2.4 to 2.75 times in the length of head. Sides of toothed area of lower pharyngeal bone concave; median length of bone 1.38 to 1.5 times its greatest width. Scaly coating of caudal fin rarely obscuring outlines of rays.

Males probably not found inshore from January to April; colour at breeding season not known, possibly black. Young sheltered in mouth of mother until they reach a length of about 40 mm. Females with young not found in the reed beds, at least from January to June. Breeding season probably October to December.

T. squamipinnis (fifteen specimens, 17.5 to 29 cm.) and *T. lidole* (two, 29 and 29.5 cm.). [The figures for *T. lidole* are given separately in square brackets.]

Depth of body 2.3 to 2.6 [2.6, 2.8] in the standard length. Length of head 2.6 to 3.1 [2.8] in the standard

length. Length of lower jaw 2·8 to 3·25 [2·7, 2·75] in length of head. Upper profile of snout in front of eye usually straight. Sides of toothed area of lower pharyngeal bone concave; median length of bone 1·29 to 1·31 [1·4] times its greatest width.

Tilapia karongæ (seventeen specimens 17·5 to 29·5 cm.).

Depth of body contained 2·4 to 2·9 times in the standard length. Length of head 3 to 3·2 times in the standard length. Length of lower jaw 2·7 to 3·3 times in the length of head (3 to 3·3 in all but one specimen). Upper profile of snout before eye usually convex. Sides of triangular toothed area of lower pharyngeal bone not concave; median length of bone 1·26 to 1·35 times its greatest width. Scaly coating of caudal fin dense, obscuring outlines of rays.

Breeding males probably dark bronze or black, found inshore August to October; no data for rest of year.

Species possibly confined to north end of lake or more plentiful there.

Tilapia squamipinnis (Günther), 1864.

Chromis squamipinnis Günther, Proc. Zool. Soc. 1864, p. 311, and 1893, p. 621 (pl. liii. ?).

Tilapia squamipinnis Boulenger, Tr. Zool. Soc. xv. 1898, p. 4, and Proc. Zool. Soc. 1899, p. 177.

T. squamipinnis (part.) Boulenger, Cat. Afr. Fishes, iii. p. 183 (fig. 118 ?), 1915.

Native names :

Chambo (females and non-breeding males in the south. general specific name at Kota Kota).

Kayawa (females and non-breeding males at Kota Kota).

Ching'Anga (pale blue breeding males, in the south).

Nchesinchesi (pale blue breeding males, at Salima).

Ngwaru (pale blue breeding males. at Kota Kota).

Kasawala, Kababa, Kambuzi (young stages of decreasing size at Kota Kota and southwards).

The Types.—These are half-skins, collected by Kirk on Livingstone's journey of 1861. They include a specimen

of 155+35 mm., which has the high-arched back characteristic of the Chambo of the natives and bears the label "Chamba." This is the only skin that can be specifically recognized with any certainty, and I therefore select it, and not the figured specimen, as the holotype, thus making *T. squamipinnis* equivalent to the Chambo of the natives.

In 1915 Boulenger had before him these skins; a specimen of *T. karongæ* collected by Moore; a pale blue male of *T. squamipinnis* and two of the black males at present referred doubtfully to this species, as well as two *T. lidole*, collected by Rhoades; two Chambo (one ♀) collected by Rendall; and several young. The specimen referred to by Boulenger as having conical teeth is a *Lidole*, but the outer teeth may become conical also in large specimens of *T. squamipinnis*, and there is nothing in Boulenger's description which might not apply to either of the three species.

Colour.—Females and non-breeding males are silvery-grey on the sides, grading to dark grey on the back and white on the belly, marked with five to eight black bars extending from the back a varying distance downwards, the foremost on the nape, the last at the base of the caudal fin.

Males.—Breeding males, named Ngwaru at Kota Kota and Ching'Anga farther south, were seen in large numbers in January and February. The top of the head and back are shining turquoise blue in colour, and the sides are silvery blue; the transverse bars are usually absent, but they may reappear in the dying fish, and are present in alcohol specimens. In March and April the breeding colours gradually give place to more dingy hues, and from May to the beginning of September the males resemble the females, except that the white marginal band of the dorsal fin is broader.

Dark specimens.—Isolated black specimens were seen during the survey. At Kota Kota these were named either Chinkulo (=the big thing) or Biliwili (=dark blue), and all examined were ripe males, with the pharyngeal bones of *T. squamipinnis*. Both Chinkulo and Biliwili appeared in large numbers in August to October according to native records (made after the expedition had left Nyasaland), and these were also males, mainly with

big testes. It is easy for an isolated specimen to receive the wrong name, and most likely either Chinkulo or Biliwili is the male of *T. lidole* and the other of *T. squamipinnis*. Provision has been made for the collection of specimens of both in the breeding season.

Another black fish, not seen by the expedition, was named Saka at the south end of the lake, where natives record three females and 41 males between June and the end of October. This may prove to be the equivalent of either Chinkulo or Biliwili; a black specimen of *T. karongæ* was labelled Saka in the Christy collection*.

Certain dark fish of both sexes were named Langasime (or Mlangasime) at the Shiré and at the Shiré bar, but these were recorded in considerable numbers only after the survey party had left, from June to October. A "Nagazeme" in Christy's collection falls within the definition of *T. squamipinnis*, but the final determination of this and its place in the life-history must await further material and field study. Three irregularly blotched and speckled males of *T. squamipinnis* were named Vyambo at Monkey Bay in May, and may possibly be the equivalent of Mlangasime.

"Zeya."—Certain specimens of 23 to 29 cm. total length were named Zeya by natives at the extreme south end of Lake Nyasa and at Lake Malombe. All seen by the writer were females, but among 28 sexed during the expedition two were recorded as male (with small testes) and five as "♂?". They are pale in colour but were identified as *T. squamipinnis*. The pharyngeal bone of one now in the British Museum collection has the proportions proper to *T. squamipinnis*, but it is small in comparison with those of other Chambo of comparable size.

Northern specimens.—It is stated above that Christy's collection from the north includes *T. squamipinnis*, but there are only two specimens, and these are not typical. They are a spent female of 204+33 mm. from Mwaya and a black fish (gonads removed; dorsal fin with broad white edge; presumably male) of 255+50 mm. from Karonga, both collected in October. Both have a more

* This has very little bearing on the identity of Saka, for if Christy had with him a native from the south, he might well have failed to distinguish *T. karongæ* from whichever species he knew as Saka.

decurved snout than is usual in *T. squamipinnis*, and the pharyngeals are larger and rather better toothed than in typical Chambo of the same size. The black fish resembles the "Chinkulo" seen during the Survey.

Several anomalies therefore remain to be explained within the limits of this species as now understood, including the presence of two kinds of breeding males, the pale blue and the black. Possibly the taxonomic analysis of this group of *Tilapias* must proceed yet farther. It is hoped that these and other problems may be solved by further field-work and collecting, especially in the breeding season, by Mr. H. J. H. Borley, the member of the fishery survey party who is permanently in the service of the government of Nyasaland.

Tilapia lidole, sp. n.

Tilapia squamipinnis (part.) Boulenger, Cat. Aft. Fish III. p. 183 (1915).

Native names :

Lidole (plural Madole). Fort Johnston to Monkey Bay.

Galamula, Salima.

Lolo (plural Malolo), Kota Kota.

The type is a specimen of 285—55 mm. from the Shiré bar, a spent female collected during the fishery survey in March 1939.

In the first three weeks of the Survey, ending about 10th February, all the Madole seen by the Survey party were large spent females, a fact that caused doubts as to its specific distinctness, which was, however, firmly insisted upon by the native fishermen in their own way, and was confirmed by discovery of the character of the pharyngeal teeth. In the Fort Johnston area, during the last three weeks of February, 78 Madole were sexed and only two were recorded definitely as male, four more as "♂?". The fishermen are unaware of the pharyngeal difference, but an experienced man recognizes the species by the physiognomical features that are so hard to express. When urged to define the distinction he always says "Lidole has a big head." Comparative measurements

often failed to confirm this, but the impression of a bigger head in *Lidole* than in Chambo (*T. squamipinnis*) is given by the larger mouth and the less arched back of *Lidole*.

The specific features include certain ethological characters, such as the continued protection of the fry by the female until they are over 40 mm. long, the associated habit of the female of not bringing her brood to the shelter of the reeds—*T. lidole* was never caught in traps set in the reeds,—and the almost total absence of males from inshore waters of the zone fished by seines, at least from January to April. Should it prove that one of the black males caught in the seines in September and October is *T. lidole*, this would indicate an inshore breeding migration. Quiet males, similar to females in colour, were caught in gill-nets not far from shore in May and June.

Tilapia karongæ, sp. n.

Tilapia squamipinnis (part.) Boulenger, Cat. Afr. Fish. iii. p. 183 (1915).

The type is a black fish, 250+40 mm. long, and the paratype is a specimen of 217+40 mm. with conspicuous black bars on a pale ground; both were collected by Christy at Karonga in October 1925. The black fish is almost certainly male; the dorsal fin has a conspicuous white margin and the genital papilla is long (16 mm.) and papillated. The paratype is probably female, and two young *Tilapias* of 20 mm., found in her mouth, are probably her own progeny.

The Christy collection includes also ten specimens from Vua (August), five from Deep Bay (August), and four more from Vua (September). A specimen of 245+40 mm. collected by Moore ca. 1899 is the only one in which the length of the lower jaw is more than one-third of the length of head.

A male of 91+20 mm. caught in September has developing testes, showing that quite small fishes may be sexually mature. A male and female with gonads near breeding condition were caught in August, and the paratype, with young in the mouth, had evidently spawned in October or just before. The breeding season of this species is probably not very different from that of *T. squamipinnis* and *T. lidole*.

Tilapia shirana Boulenger.

Oreochromis shiranus Boulenger, Proc. Zool. Soc. 1896, p. 916, fig.

Tilapia shirana Boulenger, Tr. Zool. Soc. xv. 1898, p. 4; Proc. Zool. Soc. 1899, p. 111; Cat. Afr. Fish. iii. 1915, p. 151, fig. 98.

Tilapia mossambica (part.) Boulenger, Cat. Afr. Fish. iii. 1915, p. 154.

T. shirana is related to *T. mossambica* Peters, which it resembles very closely in numbers of scales, fin rays, and gill-rakers, in the pharyngeal dentition and in proportions. It may be distinguished by the constant presence of four spines in the anal fin and by the fact that at all stages the outer teeth are markedly bicuspid and the inner tricuspid, whereas in *T. mossambica* there are only three anal spines and in mature males of all sizes the outer teeth become sparse, with the second cusp reduced or absent.

T. shirana is represented in the British Museum by over fifty specimens from Lake Nyasa and the Upper Shiré, the largest measuring 245+50 mm. Specimens of a total length of 360 mm. were seen during the Fishery Survey.

The colour in life is usually dark olive-green above, whitish or bright yellow below; in such specimens a dark band extends along the middle of the side, and there may be another above the upper lateral line. Other specimens, especially breeding males, may be much darker, nearly black, with no black band visible. In breeding males the dorsal fin has a conspicuous deep orange marginal band; a narrower orange band is present in females.

This is one of the commonest fishes of the lake and is especially abundant in reedy lagoons and estuaries, where it is caught in traps and scoop nets. It is also an almost constant constituent of seine hauls on sandy beaches. The stomachs examined contained microscopic algæ mixed usually with a very high proportion of vascular plant fragments. *T. shirana* commonly feeds on the submerged parts of the vegetation at the edges of reed-beds and sudd, and is known to the natives as a marauder of rice-fields. When phytoplankton is plentiful, however, as at times when the lake surface is clouded with the teeming vegetative phase of the Blue-Green alga, *Anabæna*, a diet of pure plankton may be taken.

A few of the specimens seen in January and February were in breeding condition, but far more were spent, showing that the breeding season was at its height before

January. It had not begun again in July when the Survey closed. Several females were found sheltering young in the mouth. These were never longer than 10 mm., and often the yolk was not completely absorbed.

T. shirana is unknown outside Lake Nyasa and the Upper Shiré. The fish from the Lower Buzi River, Portuguese East Africa, referred to this species by Boulenger, is described below as a distinct species. *T. mossambica*, which inhabits the rivers flowing to the Indian Ocean from the Webi Shebeli to the Kanoogha River near East London, has within and on the fringes of its geographical range four species with four or more anal spines, each apparently related to *T. mossambica* and replacing it in a restricted area. One of these is *T. nigra* of the Athi River; in the middle Pleistocene this occurred in what is now the Lake Victoria basin. A second is *T. hunteri* (Günther) from a crater lake east of Kilimanjaro. The third is the Buzi River fish, and the fourth is *T. shirana*. In the northern Eusso Nyiro there is a colony of *T. mossambica* in which an increased number of anal spines may occur as a variation, and I have reason to believe that another such colony, or a further related species, exists in the Shiré Highlands of southern Nyasaland. Specimens of this are not yet available.

Tilapia mossambica Peters.

The synonymy and distribution of this species have been dealt with in an earlier paper (Trewavas, 1937).

One specimen, 109+29 mm. long, collected by Christy at Karonga, is doubtfully placed here. It is more slender than specimens of either *T. mossambica* or *T. shirana* of the same size (depth 2.7 in the length). The river Ruchuru, which enters the lake at Karonga, rises in the same watershed as does the Luangwa, which flows southwards to join the Zambesi, but comparison of the Karonga fish with the Luangwa race of *T. mossambica* shows that it has a dorsal fin-ray count below the range of the Luangwa samples as well as differing in proportions. No conclusion can be drawn from this single specimen. It may be an abnormal *T. shirana* with only three anal spines, or we may find that the Ruchuru harbours a colony or a race of *T. mossambica*.

Tilapia melanopleura Duméril.

It is very doubtful indeed whether this species is distinct from *T. zillii*. The range of the two species, taken together, extends from Palestine into the Nile, Lake Rudolf, the Sahara, the West African rivers southward to Angola, and into the Zambesi and Limpopo systems. A single specimen from Lake Tanganyika (the type of *T. latifrons* Blgr., figured by Boulenger in his 'Catalogue' as *T. melanopleura*) has a very deep body, and suggests that the Tanganyika form may perhaps be subspecifically distinct from that of Nyasa. The true status of *T. melanopleura* and *T. zillii* and of several nominal species closely related to or synonymized with them can only be decided after further work including examination of types.

Fifty-nine specimens, ranging from 3 to 35 cm. in length, were handled by members of the expedition. All the females examined were spent, and, as many young of a few centimetres were seen in the reedy shallows, it is believed that the breeding season had ended not long before the middle of January (when the survey began).

The colour in life is dark green or greenish brown, with the belly pale and usually flushed with pink.

Seven stomachs were examined, and contained chopped fragments of vascular plants, sometimes mixed with filamentous algæ, in addition to small quantities of fine organic debris. A specimen caught at a time when the thick clouds of the Blue-green Alga *Anabaena* were providing the whole diet of *T. squamipinnis*, *T. lidole*, and *T. shirana*, had been feeding on filamentous algæ and *Ceratophyllum* only.

Tilapia sparrmani A. Smith.

This small *Tilapia*, which has a wide distribution in southern tropical Africa.—Bechuanaland, Angola, Transvaal, Zambesi basin, Bangueulu region, Lake Mweru and the Luapula River—is recorded for the first time from the Nyasa basin. It was not seen in the main lake, however, but in the shallow Kampambe Lagoon, formed by a small river, the Lingone, a mile or two from its entry into the lake near Kota Kota.

The colour in life is rich green with a red flush (produced by the red margins of the scales) behind the gill opening. No breeding specimens were found at the times of visiting

the lagoon (March and July). The specimens caught ranged from 5 to 15 cm. in total length, and the species is not known to exceed 20 cm.

With it in the Kampambe Lagoon, was caught *Haplochromis philander* Weber, a species with almost the same geographical range as *T. sparmmani* and also hitherto unknown in the Nyasa basin.

Tilapia placida, sp. n.

Tilapia shirana (part.) Boulenger, Cat. Afr. Fish. iii p. 151 (1915)

Depth of body less than 2 in the length, length of head $3\frac{1}{2}$. Snout about $1\frac{1}{2}$ as long as diameter of eye, which is $4\frac{1}{2}$ in length of head. Depth of preorbital 4 in length of head, interorbital width $2\frac{1}{2}$, length of lower jaw $3\frac{1}{2}$. Teeth in 5 series in upper jaw, 4 in lower, outer bicuspid with shafts a little narrower basally, inner tricuspid; 60 in outer series of upper jaw. Jaws equal anteriorly; maxillary not extending to below eye. Two series of scales on cheek. 19 gill-rakers on lower part of anterior arch. Lower pharyngeal teeth slender, bicuspid, numerous, those of two or three posterior series with cusps curved forwards. 30 scales in a longitudinal series, 4 from origin of dorsal to lateral line, 6 between pectoral and pelvic fins. Dorsal XVI 14; last spine $1\frac{1}{2}$ in length of head. Anal IV 11; fourth spine $2\frac{1}{2}$ in length of head. Pectoral $1\frac{1}{2}$ length of head, extending to above spinous anal. Caudal truncate. Caudal peduncle $\frac{2}{3}$ as long as deep. Colour (in alcohol) uniformly brown, except dorsal fin, which is faintly spotted with darker brown.

A single specimen, 153 mm. in length to base of caudal fin, from the Idunda River, Lower Buzi River, Portuguese E. Africa (south of the Zambezi) (coll. Swynnerton).

This species differs from *T. mossambica* in the presence of four anal spines and in the greater depth of body, and from *T. shirana* in the depth, in the high number of soft dorsal rays (never more than 13 in *T. shirana*), and in the smaller mouth.

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XVIII.—*Papers on Oriental Carabidæ*.—XXXVII.

By H. E. ANDREWES, F.R.E.S.

IN the following pages will be found (i.) a Key to the species of *Chlænium* found in Java, including a few new ones, described at the end of the Key; (ii.) descriptions of a few new species, mostly belonging to other genera and from other islands of the Malay Archipelago; and (iii.) a Note proposing three new generic names to take the place of others now found to be preoccupied. Types of new species are in my collection.

Key to the Javan Species of Chlænium.

- 1 (48). Venter more or less punctate along sides, though not densely, glabrous, or nearly so, along middle.
- 2 (21). Metepisterna either sulcate, or at least longitudinally depressed externally, a pale spot behind middle (except in *leucops*) on each elytron.
- 3 (12). Profemora in ♂ with a sharp tooth beneath near base (but in *atropos* the ♂ is unknown), prothorax convex, the elytral spot more or less transverse, irregular.
- 4 (7). Labial palpi with the apical joint securiform and somewhat hollowed out towards apex, length 10.5–11 mm.
- 5 (6). Prothorax green, punctate, sparsely on disk, elytral intervals finely and not closely punctate, the pale spot with a projection behind, but none in front, on interval 6 *rufifemoratus* MacI.
- 6 (5). Prothorax black with vague æneous lustre, blue in the marginal channels, closely punctate, elytral intervals moderately and closely punctate, the pale spot with projections on interval 6 both in front and behind. . . *juncus* Andr.
- 7 (4). Labial palpi with the apical joint not securiform, average length 13 mm.
- 8 (9). Palpi with the apical joint dilated (♂ only), joint 3 of antennæ flavous. . . *flaviguttatus* MacI.
- 9 (8). Palpi with the apical joint not, or scarcely, dilated, joint 3 of antennæ black, or at least dark.
- 10 (11). Prothorax finely and sparsely punctate, æneous or bluish, elytra very finely and closely punctate, the spot at a fourth from apex *bimaculatus* Dej.
- 11 (10). Prothorax moderately and sometimes confluent punctate, black with green

- lateral margins, elytra with the intervals (except 1) impunctate along middle, the spot just behind middle. . . *atropos*, sp. n.
- 12 (3). Profemora in ♂ not dentate beneath, the spot on elytra (when present) usually comma-shaped.
- 13 (20). Proepisterna impunctate, or nearly so, elytra with a pale apical spot, the striæ finely and not very conspicuously punctate.
- 14 (19). Prothorax moderately convex, the spots on the elytra flavous, curving round behind on intervals 7-8 and meeting at apex.
- 15 (16). Prothorax evidently contracted behind, elytra practically black, the spot extending inwards in front to stria 2 or even 1, average length 13 mm. . . *pictus* Chaud.
- 16 (15). Prothorax only slightly contracted behind, elytra green or æneous, the spot not extending inwards in front beyond stria 3.
- 17 (18). Prothorax rather strongly contracted in front, elytra green, the spot well developed, average length 11.5 mm. . . *hamifer* Chaud.
- 18 (17). Prothorax not much contracted in front, elytra æneous, the spot small, irregular, and tending to disappear, average length 9.5 mm. *hamatus* Dej.
- 19 (14). Prothorax flat, the spots on the elytra not curving round behind and meeting at apex [Chaud. *tetragonoderus*
- 20 (13). Proepisterna coarsely punctate, elytra bronze, immaculate, striæ conspicuously punctate, average length 12 mm. . . *leucops* Wied.
- 21 (2). Metepisterna neither sulcate nor longitudinally depressed externally, elytra immaculate (though the border or apex may be pale).
- 22 (31). Elytra with the border arcuate at shoulder, or, if there is an angle, it is very obtuse and inconspicuous.
- 23 (26). Elytral intervals costate, basal border not extending inwards beyond stria 3.
- 24 (25). Prothorax green, cordate, very smooth and shiny, practically impunctate, average length 22 mm. *femoratus* Dej.*.
- 25 (24). Prothorax cupreous, quadrate, transversely striate and finely punctate, average length 21 mm. *costiger* Chaud.
- 26 (23). Elytral intervals not costate.
- 27 (28). Elytra blue-black, with flat intervals, finely and fairly closely punctate, basal border not extending inwards beyond stria 3, average length 23 mm. *flavofemoratus* Cast.

* For colour varieties see Jedlička, 1935, *Neue Carab. aus Ostasien*, p. 6.

- 28 (27). Elytra black, the margin or apex pale, intervals moderately convex, basal border extending inwards to stria 1.
- 29 (30). Elytra pale at apex only, prothorax cupreous, quadrate, finely punctate, average length 13 mm. [& Har. *mutatus* Gemm.
- 30 (29). Elytra with a pale border, prothorax green, cordate, sparsely and irregularly punctate, average length 11.5 mm. *philemon* Andr.
- 31 (22). Elytra with the border evidently angulate at shoulder.
- 32 (45). Prothorax clearly punctate, its sides not, or only narrowly reflexed, elytra oval.
- 33 (38). Prothorax narrow, convex, with deep, linear, basal sulci, not far from the hind angles.
- 34 (35). Elytra pale at apex only, intervals moderately convex, average length 12.5 mm. *acroxanthus* Chaud.
- 35 (34). Elytra with a pale border, usually interval 9 and sometimes 8 also pale, average length 14 mm.
- 36 (37). Prothorax moderately punctate, elytral intervals convex, the punctures along their sides inconspicuous *circumdatus* Brullé.
- 37 (36). Prothorax coarsely punctate, elytral intervals subcostate, the punctures along their sides conspicuous *subcostatus* W. Macl.
- 38 (33). Prothorax not unusually narrow or convex, basal sulci often deep, but, if linear, placed about half-way between the angle and the median line.
- 39 (42). Prothorax subcordate, moderately or coarsely punctate, dull or strigose, elytra with a pale border.
- 40 (41). Labial palpi with the apical joint dilated and obliquely truncate at apex, prothorax rather closely and coarsely punctate, elytral intervals subcostate on basal half and closely punctate, average length 21 mm. *nigricans* Wied.
- 41 (40). Labial palpi not dilated at apex, prothorax moderately punctate and also covered with a dense microscopic puncturation, elytral intervals convex, average length 20.5 mm. *louwerensi* Andr.
- 42 (39). Prothorax subquadrate, rather finely and sparsely punctate, shiny, elytra without pale border.
- 43 (44). Antennæ with joint 3 hardly longer than 4, vertex almost impunctate, elytra dark blue, sometimes green along margins, dull, average length 15 mm. *quadricolor* Oliv.
- 44 (43). Antennæ with joint 3 a half longer than 4, vertex punctate, elytra black, green along margins, shiny, average length 16.5 mm. *præfectus* Bates.

- 45 (32). Prothorax impunctate or nearly so, its sides widely reflexed, elytra ovate, average length 19 mm.
- 46 (47). Prosternal process unbordered, prothorax wider than long, widest a little before middle, elytra dark violet, evidently punctate at sides [van Emd. *trigonotomoides*
- 47 (46). Prosternal process finely bordered, prothorax as long as wide, widest at a fourth from apex, elytra blue black, only vaguely punctate at sides. *perostichoides*, sp. n.
- 48 (1). Venter punctate and pubescent throughout.
- 49 (54). Elytra green or æneous, immaculate, but sometimes with pale border or apex.
- 50 (53). Antennæ with joint 3 hardly longer than 4, elytra æneous or black, with at most the border ferruginous.
- 51 (52). Labrum emarginate, hind angles of prothorax strongly rounded, elytra very convex, very finely and densely punctate, average length 11.5 mm. . [Chaud.*. *amplipennis*
- 52 (51). Labrum truncate, hind angles of prothorax a little obtuse but not much rounded, elytra rather finely and closely punctate, average length 10 mm. *seminiviridis* Andr.
- 53 (30). Antennæ with joint 3 a third longer than 4, elytra green, with the border, interval 9, and apex flavous, length 8.5 mm. *chloodes*, sp. n.
- 54 (49). Elytra blue-black, with a small, common, reddish spot near apex.
- 55 (56). Antennæ with joints 3 and 4 equal, prothorax with base wider than apex, the hind angles sharp, average length 7 mm. *guttula* Chaud.
- 56 (55). Antennæ with joint 3 evidently longer than 4, prothorax with base and apex of equal width, the hind angles rounded, average length 10 mm. *uninotatus* Andr.

Chlænius atropos, sp. n.

Length 13 mm. ; width 4.6 mm.

Black, underside iridescent ; sides of prothorax, each to the extent of about a sixth of the area, metallic green, elytra each with a transverse orange spot, irregular in outline, just behind middle, on intervals 4 to 8. Surface very shortly and inconspicuously pubescent.

Head with short, shallow, uneven furrows, diverging behind, eyes not prominent, labrum truncate, antennæ

* For var. *niasanus* Andr. see 1920, Ann. Soc. Ent. Belg. p. 26.

reaching middle of elytra, joint 3 hardly longer than 4, surface finely punctate, less closely on disk. *Prothorax* convex, nearly a half wider than head, only a little wider than long, widest at middle, base hardly wider than apex, sides narrowly bordered, reflexed behind, evenly rounded from apex to base, hind angles obtuse and a little rounded, a setiferous pore in front of each; median line well marked, basal foveæ close to the angles, fairly deep, continued forwards for a short distance as parallel lines, surface fairly closely, sometimes confluent, punctate, the punctures of different sizes. *Elytra* convex, ovate, the border not forming any angle at shoulder, a half wider than prothorax, two-thirds longer than wide, widest well behind middle; striæ deep, finely crenulate, each with a row of punctures on each side, scutellary striole long, intervals very convex, impunctate along middle, 1 conspicuously punctate. Microsculpture of the elytra isodiametric, obsolete on head and prothorax. Under-side punctate at sides, prosternal process with only a vestigial border, metepisterna rather longer than wide, externally sulcate.

JAVA: Preanger, Djampang (*Mrs. E. Walsh*), 1 ex. ♀ (ex coll. *F. C. Drescher*).

Chlænius pterostichoides, sp. n.

Length 17–20 mm.; width 6–7 mm.

Black; head and prothorax metallic green, elytra blue-black, palpi, joints 1 to 3 of antennæ, and tarsi piceous, rest of antennæ brown.

Head convex, smooth, frontal foveæ shallow, converging in front, containing a few striæ and small punctures, one or two punctures at sides behind, eyes only moderately prominent, antennæ reaching middle of elytra, tooth of mentum bifid. *Prothorax* rather flat, cordate, rather wider than head, as long as wide, apex as wide as base, widest at a fourth from apex, sides narrowly bordered, widely reflexed, rather gently rounded, faintly sinuate at a sixth from base, where there is a setiferous pore on the border, all angles rounded; median line fairly deep, lying at the bottom of a wide depression, basal foveæ deep and rather long, diverging both in front and behind, surface uneven, impunctate. *Elytra* convex.

ovate, border forming a sharp angle at shoulder, three-fifths wider than prothorax, five-sixths longer than wide, widest well behind middle; striæ deep, finely crenulate, each with a row of shallow punctures on each side; intervals convex, vaguely punctate, more clearly at sides and behind, the pores on 9 clearly umbilicate. Microsculpture isodiametric throughout. Underside almost glabrous, with a very few minute punctures along sides, prosternal process narrowly bordered, minutely setulose at apex, metepisterna hardly longer than wide, not sulcate, though externally bordered.

JAVA: Preanger, Tangkoeban Prahoe, 4000 to 5000 feet, 6 ex. ♂♂♀♀ (coll. *F. C. Drescher*).

Chlænius chloodes, sp. n.

Length 8.5 mm.; width 3 mm.

Black, upper side green; palpi, joints 1 to 3 of antennæ, legs, border, interval 9, and apex (not widely) of elytra, margin of venter (narrowly) and apical half of last segment flavous, rest of antennæ ferruginous, rest of venter piceous. Body covered with short, golden pubescence.

Head with small, rounded foveæ, eyes prominent, labrum truncate, antennæ not quite reaching middle of elytra, joint 3 a fourth longer than 4, surface finely punctate, but only a few punctures on vertex and middle of front. *Prothorax* convex, cordate, not quite a half wider than head, and as much wider than long, base oblique close to the angles, a little wider than apex, sides narrowly bordered, not reflexed, rounded in front, gently sinuate a little before base, hind angles right and a little rounded, each with a pore and seta; median line shallow, basal foveæ small and rounded, but fairly deep, surface moderately and rather closely punctate. *Elytra* convex, ovate, border rounded at shoulder, about a third wider than prothorax, not quite a half longer than wide, widest a little behind middle; striæ rather fine and finely punctate, intervals slightly convex, surface finely and closely aciculate-punctate, the punctures much smaller than those on the prothorax. Microsculpture indistinct, owing to the puncturation, isodiametric on the head and elytra, the meshes on the prothorax somewhat transverse. Underside finely punctate, prosternal process unbordered,

punctate, and setose; metepisterna a half longer than wide, not externally sulcate.

Not unlike *puncticollis* Dej., but a little smaller, the prothorax narrower, the surface of the elytra not so dull or so finely punctate.

JAVA: Cheribon, Tjideres, 300 feet, 18. xii. 1937, 1 ex. ♂ (ex coll. F. C. Drescher).

Chlænius lrisifer, sp. n.

Length 11 mm.; width 4.2 mm.

Black; head and prothorax bluish-green; palpi, joints 1 to 3 of antennæ, legs, and an apical spot on the margin of the elytra, deeper than in *acroxanthus* Chaud., but not extending so far forward along sides, pale ferruginous, rest of antennæ brown, knees piceous; elytra very dark æneous, almost black, dull, except along the tops of the costæ, and clothed with a rather sparse, golden pubescence.

Head with short, moderately deep furrows, converging in front, eyes prominent, labrum truncate. antennæ reaching middle of elytra, joint 3 a third longer than 4. surface smooth, a transverse row of punctures behind vertex, and a few at sides and in the furrows. *Prothorax* convex, cordate, as wide as head, barely wider than long, base slightly wider than apex, sides bordered, gently rounded, and equally gently sinuate before base, hind angles sharp and slightly acute, a setiferous pore in front of each; median line well marked, basal foveæ deep but not linear, converging a little in front, surface moderately punctate, a little more sparsely on disk. *Elytra* convex, ovate, shoulders oblique, the border forming a very obtuse angle on each side, nearly twice as wide as prothorax, about a half longer than wide, widest behind middle; striæ very fine, indistinctly crenulate, each with a row of punctures on each side, intervals costate, with some slight indentations here and there, giving them a faintly irregular appearance. Microsculpture isodiametric, though hardly visible on the prothorax. Underside sparsely punctate at sides, propisterna punctate, prosternal process bordered and with a tuft of hairs at apex, metepisterna punctate, a half longer than wide, not externally sulcate.

Very near *acroxanthus* Chaud., but easily distinguishable by its coloration, the form of the prothoracic basal foveæ, and the elytral costæ.

WEST CELEBES: Lindoe-Paloe, 3700 feet, viii. 1937, 1 ex. ♀ (ex coll. C. J. Louwerens).

Hexagonia spinigera, sp. n.

Length 11 mm., width 3·8 mm.

Black, shiny; joint 1 of antennæ, legs, and apex of venter piceous, palpi red.

Head rather flat, subpentagonal, longer than wide, frontal foveæ wide, shallow, uneven, longitudinally striate at sides, genæ longer than eyes, curving inwards fairly sharply to neck. hind supraorbital practically disconnected with the slight fovea behind eye, antennæ hardly extending beyond base of prothorax. ligula deeply cleft, submentum with two setæ on each side, surface smooth, a few small punctures at middle of neck. *Prothorax* rather flat, cordate, a little wider than head and a little wider than long, base truncate, slightly wider than apex, widest rather before middle, sides gently rounded. a little sinuate behind, a pore on each side at widest point (setæ abraded), none at hind angles, which are sharp and right; median line deep, basal foveæ deep close to base and continued vaguely forwards, lateral sulci a little removed from margin at middle, not quite reaching base and bending outwards behind, surface impunctate, vaguely transversely striate. *Elytra* moderately convex, two-thirds wider than prothorax, three-fifths longer than wide, widest at middle, sides rounded, sinuate before apex, a stout spine on each side of the re-entrant apical angle; striæ fine and finely punctate, rather deeper behind, 1 and 2 arising in an umbilicate pore; intervals flat, convex near apex, 8 and 9 narrower than the rest, 3 with three pores, near base and at three-fifths and five-sixths respectively, 5 with a single pore at three-fourths. Microsculpture of elytra isodiametric, none on head, vague transverse lines on prothorax. *Sterna* and venter as in *Hexagonia*, practically impunctate, but the short longitudinal sulcus on the base of the mesosternum is very deep and bounded on each side by a sharp ridge; claws without any projecting tooth at middle.

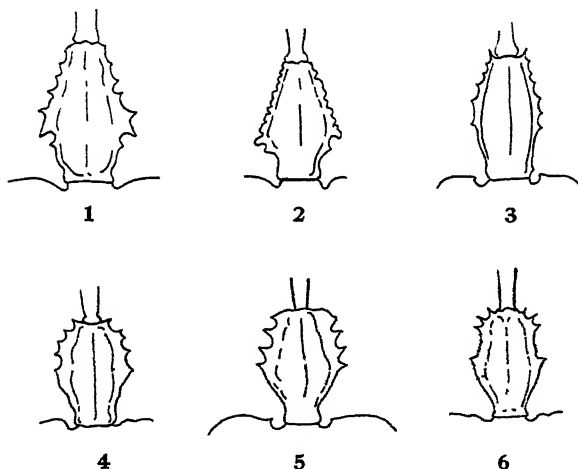
An abnormal species, the elytral spines recalling the Malagasy genus *Omphreoidea*. For the present it seems best placed in *Hexagonia*.

S.W. CELEBES: Bonthain, Ereng-Ereng, 1 ex. ♂, for which I am indebted to Mr. C. J. Louwerens.

Mormolyce tridens, sp. n.

Length 73 mm.; width 33.5 mm. Colour brown.

Head long and narrow, moderately flattened, depressed between the eyes but not sulcate, eyes hemispherical, neck narrowing behind and curving downwards, antennæ reaching level of metacoxæ. Prothorax a little shorter than head, but nearly twice as wide, not much contracted



- | | |
|------------------------------------|---|
| 1. <i>M. phyllodes</i> Hagend. | 2. <i>M. phyllodes</i> var. <i>borneensis</i> Gestro. |
| 3. <i>M. hagenbachii</i> Westw. | 4. <i>M. castelnaudi</i> Deyr. |
| 5. <i>M. quadratocollis</i> Donck. | 5. <i>M. tridens</i> Andr. |

(Drawn by O. F. Tassart, nos. 1-5 after Rousseau, no. 6 from the type.)

in front, the margin reflexed and furnished at each front angle with three equally spaced, sharp teeth, then moderately dilated to middle, where there is a larger and equally sharp tooth, behind and in front of which are some minute serrations, then narrowed to about a sixth from base, the hind angles right, but with the raised basal margin

extending on each side a little beyond them; median line in the form of a carina, not quite reaching base or apex, basal sulcus moderately impressed, surface uneven, finely transversely striate. *Elytra* similar to those of the other species of the genus, shoulders with a rounded tooth on each side of the prothorax, the undulations on the apical half of the foliaceous expansions transverse, characters found also in *M. castelnaudi* Deyr.

Compared with the well-known *M. phyllodes* Hagemb., the head is longer, narrower, and much less flat, the downward curve behind more pronounced, the antennæ shorter and much more slender, especially the first joint. The form of the prothorax is quite dissimilar, as shown in the accompanying illustration. The elytra are not more than three times as long as the prothorax (3.75 times in *phyllodes*), the humeral teeth more evident, the striæ and tubercles less marked, and no teeth on the postero-internal marginal edges. In both species there is a vague microsculpture of fine transverse lines.

BORNEO: Balikpapan (*M. Hardonk*), 1925, 1 ex., for which I am indebted to Mr. C. J. Louwerens.

Lioptera louwerensi, sp. n.

Length 9-10 mm.; width 3.8-4.4 mm.

Black, with two large orange spots on each elytron.

Head with deep frontal impressions, rounded in front but continued behind to mid-eye level, each bounded outwardly by a rounded, longitudinal ridge, surface finely punctate, more closely in front, some fine longitudinal striation between the eyes. *Prothorax* a little wider than head, rather more than twice as wide as long, not much contracted behind, base bisinuate, front angles rounded away, sides bordered, rounded, explanate, bisetose, hind angles somewhat obtuse and a little rounded; transverse impressions deep, basal foveæ deep and wide, surface finely and irregularly punctate-striate, a few larger punctures at sides. *Elytra* convex, two-fifths wider than prothorax and two-fifths longer than wide, truncate at apex, each with an inner spine and an outer tooth at the ends of the truncature; striæ formed by fine punctures, 1 impressed close to apex; intervals flat,

four dorsal pores, surface finely, irregularly, and sparsely punctate. Microsculpture isodiametric, but in some aspects the surface appears to be microscopically punctate.

The orange spots on the elytra are transverse, though very irregular. The front one sends out in front a short arm on interval 3 and a longer, wide one, reaching base on 5 and 6, while behind there are short arms on 4 and 6; the hind one sends out in front short arms on 3, 5, and 7, and behind on 4 and 7; both spots extend inwards to stria 1, while outwards the front spot reaches stria 9, and the hind one stria 8.

In Heller's key to the species (Ann. Soc. Ent. Belg. xlvii. 1903, p. 241) the nearest ally is *L. pseudo* Hell., but that species has paler spots and no apical spine.

SALAYER: Somarisi, 8 ex. ♂♂♀♀ (coll. C. J. Louwerens).

NOTE.

The following new generic names are proposed to take the place of others now found to be preoccupied:—

MINUTHODES nom. nov. for PLATIA Chaudoir, 1869, Ann. Soc. Ent. Belg. xii. p. 155 (*nec* Hübner, 1820, *nec* Dejean, 1834, *nec* Agassiz, 1846).

SYLETER nom. nov. for PSILUS Putzeys, 1877, Compt. rend. Soc. Ent. Belg. xx. p. 46 (*nec* Panzer, 1806, *nec* Fischer de Waldheim, 1813).

XENODOCHUS nom. nov. for XENODUS Andrewes, 1924, Miss. Babault Inde, Carab., p. 92 (*nec* Miller, 1892).

XIX.—*The Developmental Stages of Metis jousseau mei* (Richard) (Copepoda, Harpacticoida). By A. G. NICHOLLS. University of Western Australia.

WHILE on a visit to Dongarra (40 miles south of Geraldton, Western Australia) in March 1940, collections of copepods were made from the extensive limestone reefs in that region. A handful of algæ taken from such a reef, covered by a foot of water (there is practically no tidal range on the south-west coast of Western Australia), contained

a large number of *Metis*. A few adult females, bearing spermatophores, were isolated in an attempt to rear the young, but did not survive. The remainder of the collection was preserved, and from a small portion of the sediment over 100 specimens, in all stages from 1st nauplius to adult, were obtained.

These were identified as *Metis jousseaumei* (Richard, 1892), and although no nauplii were reared there can be no doubt that those taken in this collection belong to this copepod, as is shown by the accompanying drawings.

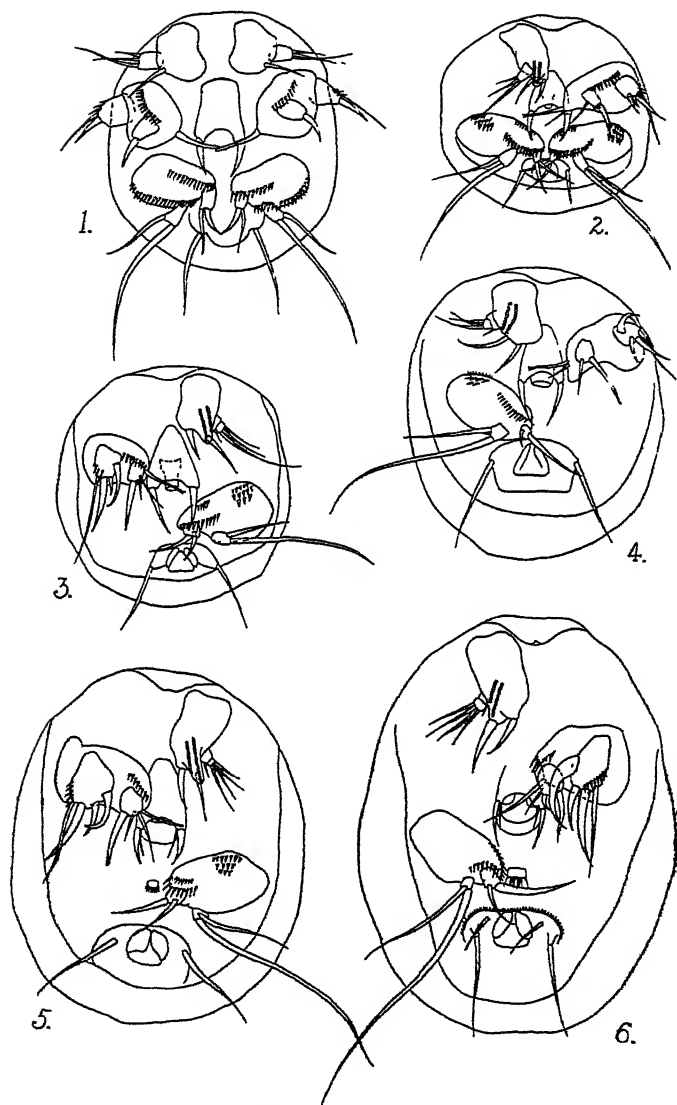
The colour of the specimens was mainly a deep blood-red, some were slightly paler while a few were colourless. On preservation the colour gradually disappears; specimens which were bright red when taken at Rottneest Island (near Fremantle) a year ago and preserved in 5 per cent. formaldehyde, are now colourless. The majority of the nauplii taken at Dongarra were coloured like the adults, with a few colourless individuals; the eggs, of which two were found enclosed in the remains of an egg mass, were also bright red. No females were found carrying egg-sacs.

The eggs are oval in shape, and measured about 0.06 by 0.045 mm.

The nauplii (about 50 examined) when measured fell into six distinct size groups suggesting that, as with other Harpacticoids, there are six stages. This cannot be confirmed by examination of the stages for, as shown in fig. 1, there is no change, apart from size, between some of the stages.

Where possible, dissections were made of the nauplii but, as they are rather small, the younger ones had to be examined from whole mounts. As in the adults, the chitin is very tough, and when mounted in Monk's (1938) medium (the use of which enables small objects to be mounted direct from aqueous solution and placed in a desired position before covering) an immediate collapse occurs and the nauplii, which are spherical in shape with a flattened ventral surface, immediately become concave ventrally, so that the appendages are folded inwards and are difficult to examine. An attempt to overcome this difficulty by placing the nauplii in diluted medium and gradually increasing its strength was only partially successful. The drawings in fig. 1 were made from

Fig. 1.



Nauplius stages 1-6 as numbered, from ventral surface.

All except the first have suffered some shrinkage. In some cases a certain amount of detail has been added from dissected specimens. The 1st nauplius was drawn under a magnification almost twice that of the other five.

specimens treated by this method. (Puncturing the integument before placing in Monk's medium overcomes this difficulty, but could not be practised with the nauplii, which were difficult to manipulate owing to their shape.)

1st nauplius stage (fig. 1).—Average size 0·073 mm. (3 specimens). In outline at this and the two following stages the nauplius is almost circular. The typical three pairs of appendages are present, also a labrum and two tail setæ.

The *labrum* is bifurcate posteriorly, each point armed with a curved spine.

The *1st antenna* is composed of a large basal segment with one spine and a small second segment with three terminal setæ.

The *2nd antenna* has a wide basal segment with an inner spine projecting towards the labrum, and a single row of spinules. The inner spine has a peculiar structure in later stages, which can usually be made out only by dissection, so that it is not known if this structure is present in the 1st stage. There are two 1-segmented rami, the anterior bearing one spine and one seta terminally, and a fringe of small hairs; the posterior ramus has one terminal spine.

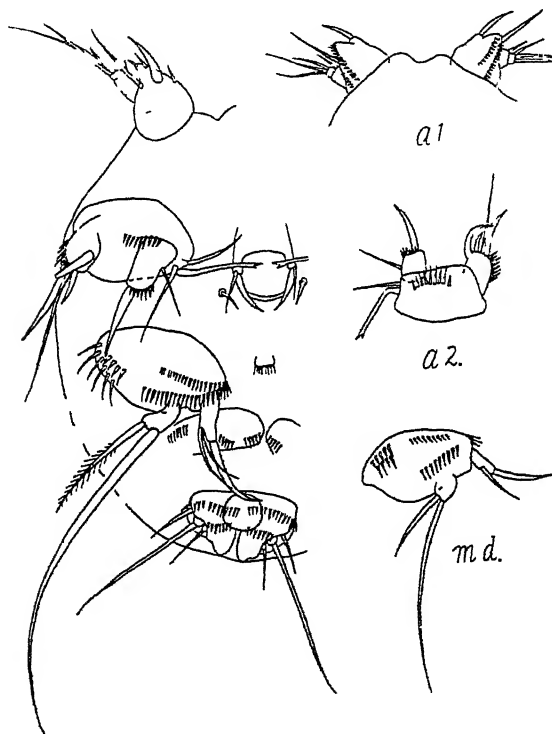
The *mandible* is composed of a large oval basal segment with two rows of spinules, and has two 1-segmented rami; the inner ramus is tipped with one spine and one seta; the outer, which persists practically unchanged to become the mandible palp of the adult, has two terminal setæ, one of which is very long.

Posteriorly there are two tail setæ.

2nd nauplius stage (fig. 1).—Average size 0·099 mm. (14 specimens). Apart from the appearance of the rudiments of a rostrum and a small funnel-like mouth beneath the labrum, there is little change from the preceding stage. The *1st antenna* now shows the two series of tubercles on the basal segment, which persist in the adult, and this segment is taking on the adult shape. There are now two spines on the basal segment, but the 2nd segment is unaltered. The *2nd antenna* has an additional inner seta on the basal segment, two extra spines on the outer ramus, and an inner lateral seta on the inner ramus. The peculiar inner spine on the basal segment of the 2nd antenna, referred to above, is bent at right angles

near its attachment, and is bifid at the extremity. It is apparently concerned with feeding, since it lies across the labrum, where it meets the corresponding spine from the other side (fig. 2). The *mandible* is unaltered except for additional spinules on the basal segment.

Fig. 2.



The 6th nauplius from the ventral surface, showing rudimentary mouth-parts.

1st antenna (*a.1*), 2nd antenna (*a.2*), and mandible (*md.*) of 4th nauplius.

3rd nauplius stage (fig. 1).—Average size 0.120 mm. (10 specimens). The chief advance here is in the distal portion of the 1st antenna which has become 2-segmented, *Ann. & Mag. N. Hist.* Ser. 11. Vol. vii. 21

the proximal segment with one lateral seta, and the distal segment with three terminal setæ. The 2nd antenna and mandible are unchanged.

4th nauplius stage (figs. 1 and 2).—Average size 0·134 mm. (9 specimens). There is no change in the appendages from the condition in the previous stage. The labrum has lost its definition anteriorly and is merged in the body ; posteriorly it projects in its two curved spines.

5th nauplius stage (fig. 1).—Average size 0·155 mm. (10 specimens). The shape of the body is becoming more elongate, and this and the next stage have a rather cubical shape with rounded corners and sides, and distinctly convex dorsally and posteriorly. This shape is lost in the whole mounts owing to the collapse of the ventral surface.

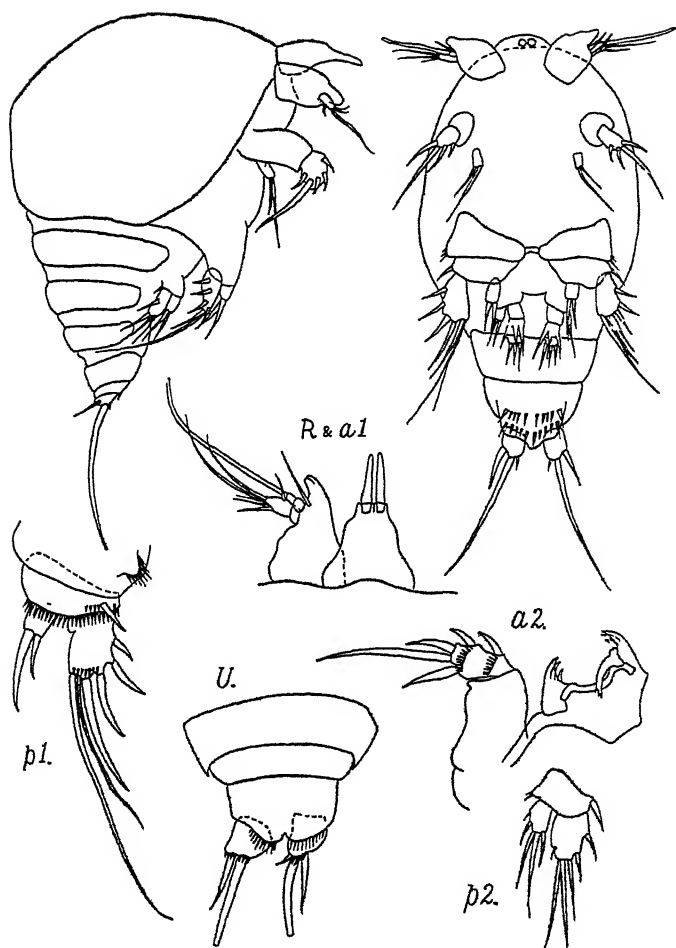
The labrum now has an extra pair of setæ, and the armature of the appendages shows a slight development. A small rudimentary appendage appears between the mandibles, being a plate fringed with eight setæ.

6th nauplius stage (figs. 1 and 2).—Average size 0·185 mm. (6 specimens). The rudimentary rostrum shows a tendency to become bifurcate, apart from which there is little change. Fig. 2, in which is illustrated a 6th nauplius which has been partially dissected by removal of the dorsal half of the body to avoid the shrinkage referred to above, shows two more pairs of mouth-parts. The 1st maxillæ, represented by a pair of small knobs, from each of which projects a short spine, lie on either side of the labrum posteriorly. The fringed plate, occupying an almost central position on the ventral surface (first seen in the 5th nauplius), is apparently the rudiment of the 2nd maxillæ, as can be seen by comparison with the illustration of these appendages in fig. 5. No trace of the maxillipeds could be found, but the rudiments of the 1st legs appear just behind the mandibles.

The nauplius stage is clearly a feeding stage in *Metis*, and there is no indication of abundant yolk. The structure which persists as the mandible palp of the adult is present in the 1st nauplius and remains unchanged. Rudiments of the mouth-parts develop only in the later nauplius stages.

Copepodite stages.—The size frequency distribution of the copepodites again indicates six stages, including

Fig. 3.



The 1st copepodite and its appendages.

Lateral view from specimen measuring 0.30 mm., ventral view from one measuring 0.18 mm. (drawn under greater magnification). The appendages came from the larger specimen.

the adult, but their actual sizes are not so clearly defined as in the nauplii. The sizes, based on measurements of 50 specimens, are approximately as follows :—

Copepodite stage	I.	II.	III.	IV.	V.	VI.
Size in mm. . . .	0.30	0.36	0.42	0.50	0.66	0.80

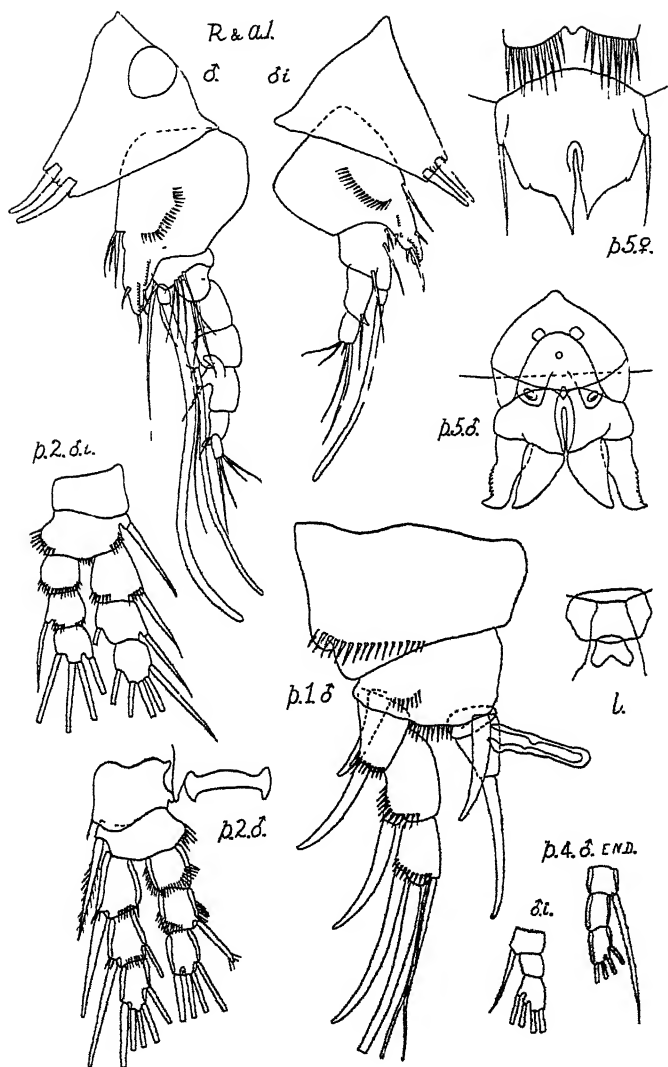
One first copepodite stage was found which was no larger than the 6th nauplius (fig. 3). There is little of interest in the development of the copepodites, the first having all the main characters of the adult, including the reduced mouth-parts. Subsequent development is merely a case of elaboration of the swimming-legs and eventually of the sexual characters.

In connexion with the swimming-legs it should be noted that Gurney's seta formula (1927, p. 571) differentiates between setæ and spines in the terminal segments of the rami, whereas it is perhaps of more interest to indicate the arrangement of these setæ or spines. In this case the seta formula becomes :

	Endopod.	Exopod
P. 2	0. 1. 121.	0. 1. 131.
P. 3	1. 0. 220.	0. 1. 231.
P. 4	1. 0. 220.	0. 0. 231.

The arrangement of the setæ and spines is not always clear, and this is particularly so in the case of adults of *M. jousseaumei*. In fig. 4 are shown the 2nd legs of an adult and of an immature male. In the adult the terminal segment of the endopod appears to have one inner and three terminal setæ, whereas actually there are only two terminal setæ, the third being an outer seta, terminal in position owing to the lack of development of the distal portion of the segment. This is clearly seen by an examination of the same leg from an immature male, in which the outer seta is distinctly separated from the two terminal setæ by a small notch. The segments in immature specimens are only slightly chitinized, but in the adult chitinization is marked and forms a useful guide to the arrangement of setæ, since there is always a break in the chitin at the base of a seta. This can be seen in the legs of the adult, which also show chitinization between the outer seta and the terminal setæ of the 2nd endopod. In the adult the notch has become closed,

Fig. 4.



R. & a.l., rostrum and 1st antenna of adult male and immature (*i.*) male ; *p.1*, 1st leg of male ; *p.2*, 2nd leg of adult and immature (*i.*) male ; *p.4 end.*, 4th endopod of adult and immature (*i.*) male ; *p.5*, 5th legs of male and female ; *l.*, uniting lamella of 1st legs of male.

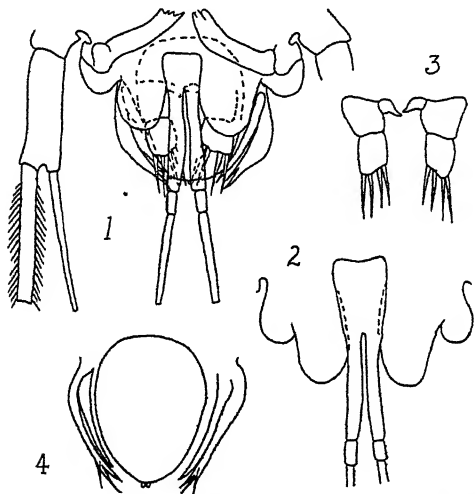
giving the appearance of three terminal setæ, but the chitinization proves this to be incorrect. A similar condition is observed in the 4th endopod which, in the adult, appears to have one inner and three terminal setæ, whereas there are really two inner and two terminal setæ (fig. 4, p. 4. end). In the drawings of the 2nd and 4th legs of the immature males the width of the notches between the setæ has been slightly exaggerated to illustrate this point. (In this paragraph the term "seta" has been used in a general sense, ignoring the fact that the outer "seta" of the endopods (when present) is usually a spine, in *Metis*.)

It is of interest to note that the adults from Dongarra attain a size considerably greater than that reached in other localities from which this species has been taken.

Steuer (1937), in a review of the species of *Metis*, gives 0.588 mm. and 0.560 mm. as the maximal size attained by the female and male respectively of *M. jousseaumei*, and no other species attains a greater size. The largest female found at Dongarra was 0.84 mm., and the largest male 0.825 mm. It is somewhat surprising, therefore, to find that there is not one structural difference on which this material could be separated from *M. jousseaumei*. Specimens from Rottnest Island and from Spencer's Gulf, South Australia, are of the usual size for the species. The seta formula of the swimming-legs is as stated by Steuer (*l. c.*, p. 9), and the same in both sexes. The first legs of the male differ very slightly in the structure of the inner spine of the endopod. Gurney (1927, p. 570) finds no difference between male and female except in the 1st antennæ and 5th legs. Wilson (1932, p. 308, fig. 185) shows this spine to be somewhat enlarged when compared with that of the female, and attached laterally. In specimens from Spencer's Gulf it is enlarged and attached at the base of the distal segment; in those from Rottnest Island it is exactly as shown by Wilson; and in the Dongarra material it is considerably enlarged, does not taper but ends bluntly rounded, and has a point of attachment similar to those from Woods Hole and Rottnest Island (fig. 4). The Spencer's Gulf and Rottnest Island material agrees with that from Woods Hole in having a pair of lateral setæ on the rostrum, whereas in the Dongarra material these are absent, as shown also in

Gurney's drawing (*l. c.*, fig. 167). The peculiar uniting lamella between the 1st legs of the male referred to by Gurney (*l. c.*, p. 568) is present in all the specimens examined by me (fig. 4, *l.*). As pointed out by Gurney, therefore, the only difference by which *M. sarsi* Sharpe (1910) could be distinguished from *M. jousseaumei* (Richard) is in the structure (and position) of the inner spine on the 1st endopod of the male. To this should

Fig. 5.



1, mouth-parts in normal position from below; 2, paragnaths of lower lip and maxillipeds; 3, 2nd maxillae; 4, upper lip and 1st maxillae.

be added the lateral setae of the rostrum. As shown above, the Dongarra specimens combine the absence of lateral setae on the rostrum in *M. jousseaumei* as described by Gurney, with the enlarged spine on the male 1st endopod in *M. jousseaumei* (= *M. sarsi*) from Woods Hole. In Scott's (1894) material from the Gulf of Guinea the rostrum is without lateral setae and no reference is made to the male first legs.

As to the mouth-parts, which have been described by Gurney (*l. c.*, fig. 166), even in these large specimens it was not possible completely to separate the various parts. Fig. 5 shows the assembled parts and the various

components at different focal levels, drawn as they appeared to me. The upper lip is oval, with two minute posterior projections. The mandibles lie beneath and project upwards and inwards as described by Gurney—their palps lie at a lower level, being attached to the proximal end of the mandible, which is curved as shown by Sars (1911, pl. ccxxviii.) for *M. ignea*. The 1st maxillæ lie lateral to the lip and appear to have a considerable depth, but their structure could not be made out clearly, although the structure present in the 6th nauplius appears to persist as a gnathobase lying close to the lip. The 2nd maxillæ are 2-segmented; the basal segment has an inner cutting process, and the end segment has two terminal and two inner setæ. The lower lip is divided into two paragnaths, between which lie the maxillipeds. The maxillipeds and mandible palps need no further description.

I am indebted to Mr. H. M. Hale, Director of the South Australian Museum, Adelaide, for the opportunity of studying material from their collections, and to my father, Professor G. E. Nicholls, who collected the material taken at Rottneest Island.

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THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 41. MAY 1941.

XXVI.—*Notes on Thalassinid and Processid Larvæ (Crustacea Decapoda) from Bermuda.* By MARIE V. LEBOUR. D.Sc., Naturalist at the Plymouth Laboratory.

I. THE SPECIES OF *PROCESSA* FROM BERMUDA.

Verrill (1922) records only one species of *Processa* from Bermuda which he called *Processa canaliculata* Leach var. *bermudensis* (Rankin). Rankin (1900) considered it to be a distinct species, and named it *Nika bermudensis*. Gurney (1936 a) confirmed Rankin's opinion and redescribed it as *Processa bermudensis* Rankin, at the same time working out its larval forms. In 1938 we took this species frequently whilst dredging in the Reach at night, females in berry continuing from at least June to October and larvæ occurring in the plankton almost throughout the year. The male is described below. Three other *Processa* larvæ were found. One from the Reach and outside agreed with *P. bermudensis* in structure and size, but differed so entirely in the colouring that it is probably distinct. Unfortunately all these died, but it is worth putting on record that they existed. Another larva from the Reach and outside was recorded by Gurney (1936 a) as being hardly distinguishable from *P. canaliculata* and probably that species. On further investigation it seems that this also is different although closely related. Finally a fourth form was found in the plankton from outside. Only a few specimens

were obtained, one of them being a last larva which moulted in the Laboratory to the post-larva, and this again moulted ten times, the resulting eleventh stage being killed and preserved. Here we have a new species, a male, with all the adult characters. Three younger larvæ of this form were obtained by Gurney, and one more last larva was taken in June 1939 which moulted to the post-larva. This new species is of the usual *Processa* form of the *canaliculata* type, but the larva differs very appreciably from that species and closely resembles Coutière's (1906 b) *Hectarthropus nikiiformis*, which he refers to the Nikidæ (=Processidæ). These came from near Teneriffe, caught in a large-mouth net, between 1000 metres and the surface. He does not mention the exopods on the legs. His latest larva measured about 13.5 mm. in length, rather longer than the last larva (ca. 12 mm.) from Bermuda which changed to a post-larva. It is slightly less developed than this last larva from Bermuda, coming in between Stages VIII and IX, the pleopods and antennal flagellum not so long as in the Bermudan last larva (IX), the telson bearing ten terminal spines. In stage VIII (?) from Bermuda there are twelve and in IX there are eight only. It is more like the *Processa* sp. from Australia described by Gurney (1937 a), belonging to the *Hectarthropus* larval genus of Bate (1888). I am much indebted to Dr. Gurney for allowing me to use his private notes and specimens of this larva and the unknown form of the *canaliculata* type.

There must be at least three, and probably four, species of *Processa* in Bermudan waters, none of which belongs to the true *Processa canaliculata*. As Gurney states (1937 a) the adults of *Processa* are much more alike than the larvæ, and he remarks that his Australian larva may belong to a quite normal species of *Processa*. This suggestion is borne out by the fact that the new species here described has a larva of the same type as his Australian species (except that it has no spine on the second abdominal somite) with an adult resembling closely *P. canaliculata*.

I propose for my new species, of which at present only the male is known, the name of *Processa wheeleri*, after Dr. Wheeler, Director of the Biological Station, Bermuda.

Processa wheeleri, sp. n. (Figs. 1-9, 11-27.)

The last larval stage of this species was taken about 5 miles from Bermuda in 150 metres by the 'Culver,' February 6th, 1939. It was pale yellow in colour, with a few red chromatophores ventrally on the thorax and abdomen. Whitish opaque chromatophores also occur, notably on the eyes. The body is broad and much flattened dorso-ventrally, and there is a conspicuous bend at the third abdominal somite. A second specimen of a last larva was also obtained, which was preserved, the locality not stated, and a third, taken June 1939, changed to a post-larva which died. This last specimen was very red in the thorax. Three earlier larvæ (probably stages VII and VIII) taken by Gurney in June 1938 were labelled "red *Processa*." It is probable that the changes in colour are considerable. The pale yellow last larva turned pink in all the following stages and at night was often a brilliant reddish pink.

Stage VII ?.—Two specimens (Gurney, 1938), ca. 7 mm. in length. The same form as the last larva; the right first leg and both the second legs are chelate; the pleopods are fairly long and bilobed, the endopod being about half the length of the exopod, with a trace of setæ at the tip. The telson has two pairs of spines dorsally, the proximal pair minute, and 12 setæ at the end. There are exopods on legs 1-4. Those of the third maxilliped and legs 1-3 bear 16 setæ, of leg 4, 12. The antennal flagellum reaches slightly beyond the scale.

Stage VIII ?.—Length ca. 9 mm. This stage comes between Stage VII ? and the last and closely resembles these. The pleopods, antennular and antennal flagella are longer; the telson is like VII; there are 18 setæ on the third maxilliped and legs 1-3, 14 on leg 4.

Stage IX ?.—*Last larval stage* (figs. 1 & 2).—Length 12 mm. The rostrum is long, reaching nearly to the eyes, and pointed. There are conspicuous supraorbital and antennal spines and a long spine just above the pterygostomial angle with several teeth behind. There are conspicuous prominences dorsally behind the rostrum and in front of the posterior margin of the carapace. The fifth abdominal somite has a pair of long dorso-lateral spines, the sixth

a small pair. The telson in the whole specimen has two pairs of dorsal spines, the proximal pair extremely minute, but in both the cast skins there is only the distal pair, thus resembling *Processa* sp. from Australia. The telson ends in eight spines in all three specimens, the outer spine being the largest. In having only eight spines it differs from all other larval *Processa*. The antennule is long, with the two flagella well developed; the antennal scale reaches nearly to the end of the antennular peduncle, the flagellum being about twice the length of the scale. The exopod of the third maxillipede has 18 setæ, of legs 1 and 2 22 setæ, of leg 3 20 setæ, and of leg 4 18 setæ. The right leg has the chela well developed, and so also have the second legs. The pleopods bear several setæ.

The last larva changed to a post-larva on February 10th, and this moulted to later stages on the following dates:—February 19th, March 14th, March 23rd, April 2nd, April 14th, April 23rd, April 29th, May 6th, May 16th, May 26th, June 4th, and June 11th. Killed and preserved June 17th.

Post-larva from last larva (figs. 3–5).—Whole specimen 10 mm. long. Of nearly adult form, but with shorter legs. There are long remnants of exopods on the legs and the exopod of the third maxillipede has minute traces of setæ. The second legs are jointed. Legs 3 and 4 have two spines on the ischium and four on the merus. There are five spines on the propodus of the fifth leg. The sixth abdominal somite is much shorter than in the last larva. The first pleopod has a short unmodified endopod, and there is no appendix masculina on the second. The antennal scale is about two-thirds the length of the body; the rostrum is bifurcate, with the upper lobe shorter than the lower; there is a tuft of setæ between the lobes and a few hairs on the main part.

First moult from post-larva (fig. 6), cast skin.—The rostrum is rather more hairy. Legs 3 and 4 are as in the post-larva. The exopod of the third maxillipede is setose. The first and second pleopods were lost.

Second moult.—Legs 3 and 4 have five spines on the merus as in the adult. The endopod of the first pleopod is beginning to be modified, but is still setose at the tip. The second pleopod was lost.

Third moult.—The cast skin was lost.

Fourth moult.—The cast skin was much damaged and the pleopods and legs lost.

Fifth moult.—The legs and pleopods are as in the adult. *Sixth, seventh, eighth, ninth, and tenth* moults like the adult. Thus the fifth stage and possibly an earlier stage has the adult features even to the male pleopods. The stage obtained from the tenth moult was killed and preserved and described as the adult male.

Adult male. 14 mm. long (figs. 7-9, 11-27).—The rostrum is slender, reaching nearly to the eye, not much widened at the base, bifid at the end, the dorsal lobe about half the length of the ventral; there are long setæ between the lobes and long hairs all along the dorsal, ventral, and lateral sides of the rostrum. The eyes are large, reaching nearly to the end of the first segment of the antennular peduncle. The carapace has a small antennal spine. The fifth abdominal somite is bluntly angular behind, much as in *P. canaliculata*. The telson has two pairs of dorsal spines and ends in a point with three pairs of spines each side, the first and second very thick and solid, the second the longest, the third thin and feathered. The first segment of the antennular peduncle is slightly longer than segments 2 and 3 together, the second slightly longer than the third; the inner flagellum is nearly half the length of the body, the outer with a long and thick portion thickly armed with bundles of aesthetes for almost the whole length; the stylocerite has an almost flat anterior margin with an outer tooth and setose outer margin (that of *P. canaliculata* (fig. 10), which resembles it in form, being rounded on the anterior margin). The antennal scale is about seven times as long as wide and narrower than the eyes. The descriptions of the appendages are taken from the tenth moulted skin, the propodus of the fifth leg of the preserved specimen being compared and drawn. The mandible has two large teeth on the incisor process besides some small teeth, the process bent down and fused with the molar process in the usual way. The antennule has the usual twisted and hooked endopod, but both lobes end in a seta. The endopod of the maxilla is short and unsegmented and bears a small seta at the tip. Maxillipede 1 and 2 are as in *P. canaliculata*. Maxillipede 3 reaches beyond the antennal scale by the whole of the last and half the penultimate segment, the exopod being about

a third the length of the first segment. The first leg is chelate on the right and simple on the left, the carpus being much shorter than the propodus, the merus longer than the carpus and propodus together. The right

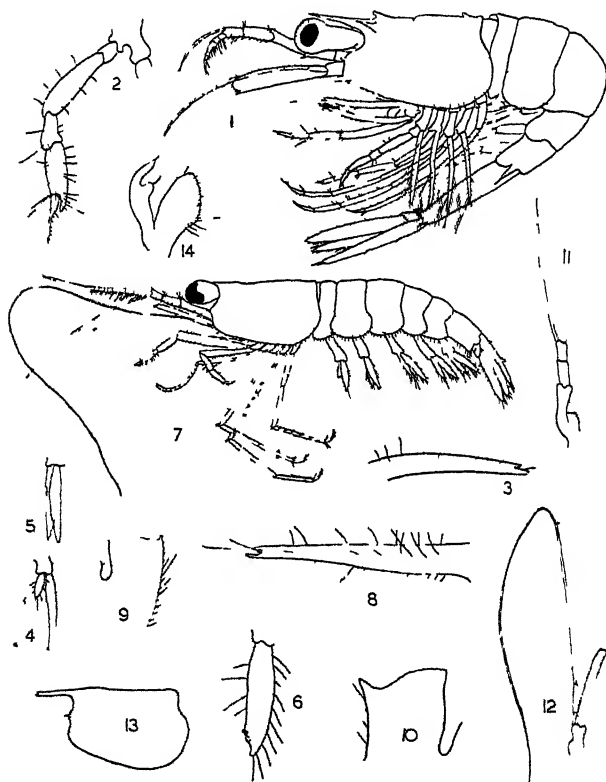


Fig. 1.—*Processa wheeleri*, sp. n. Last larva, ca 12 mm. long.

Fig. 2.—Ditto. First right leg of same.

Figs. 3-5.—Ditto. Post-larva. 3, rostrum; 4, first pleopod, ♂; 5, second pleopod, ♂.

Fig. 6.—Ditto. Endopod of first pleopod, second moult from post-larva ♂.

Fig. 7.—Ditto. Adult ♂, moulted from last larva through post-larva and ten moults, 14 mm. long.

Fig. 8.—Ditto. Rostrum of same.

Fig. 9.—Ditto. Stylocerite of antennule.

Fig. 10.—Stylocerite of antennule of *Processa canaliculata*.

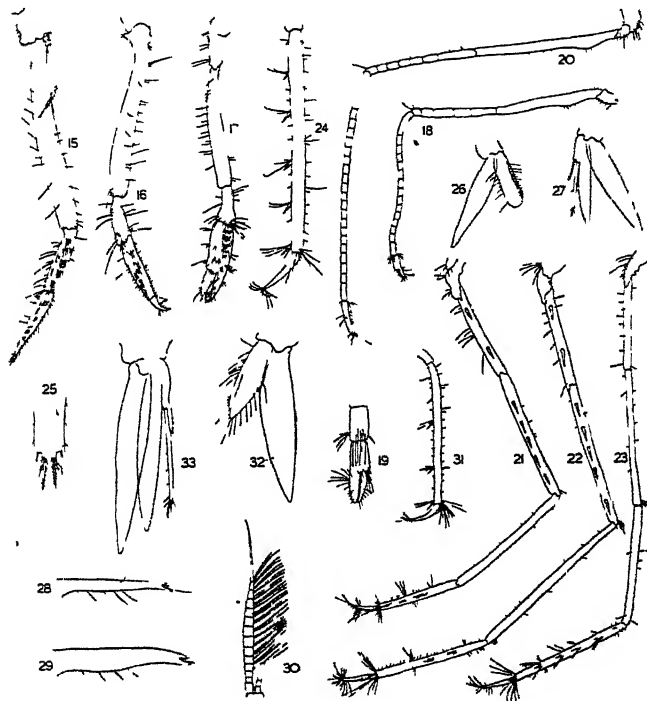
Fig. 11.—*Processa wheeleri*, sp. n., ♂.—Antennule.

Fig. 12.—Ditto. Antenna.

Fig. 13.—Ditto. Carapace from side.

Fig. 14.—Ditto. Maxillule.

second leg is longer than the left, the mero-carpal bend of the right reaching as far as about a third of the antennal scale, with about 23 segments in the carpus and seven in the merus, the left mero-carpal bend reaching about



- Fig. 15.—*Processa wheeleri*, sp. n., ♂. Third maxillipede.
 Fig. 16.—Ditto. First leg, right
 Fig. 17.—Ditto. First leg, left.
 Fig. 18.—Ditto. Second leg, left
 Fig. 19.—Ditto. End of same.
 Fig. 20.—Ditto. Second leg, right
 Fig. 21.—Ditto. Third leg.
 Fig. 22.—Ditto. Fourth leg.
 Fig. 23.—Ditto. Fifth leg.
 Fig. 24.—Ditto. Dactyl and propodus of fifth leg.
 Fig. 25.—Ditto. Telson.
 Fig. 26.—Ditto. First pleopod.
 Fig. 27.—Ditto. Second pleopod.
 Fig. 28.—*Processa bermudensis*. Rostrum, ♂.
 Fig. 29.—Ditto. Rostrum, ♀.
 Fig. 30.—Ditto. Antennular flagellum, ♂.
 Fig. 31.—Ditto. Abnormal fifth leg (propodus) of ♀.
 Fig. 32.—Ditto. First pleopod, ♂.
 Fig. 33.—Ditto. Second pleopod, ♂.

halfway to the eye, the carpus with about 15 segments, the merus with about five. Leg 3 reaches beyond the antennal scale by the propodus and part of the carpus; there are two spines on the ischium and five on the merus. Leg 4 is slightly longer than 3, with two spines on the ischium and five on the merus, the propodus about two-thirds the length of the carpus. Leg 5 has no spines on the ischium and merus, but has five long spines, serrated along one edge, on the propodus, with tufts of setæ; the propodus and carpus are equal. The first pleopod has the endopod rounded and bare at the end, as in the figure, the second has the appendix masculina reaching to about two thirds down the endopod, with spines for the distal two-thirds on the margin next the endopod and a tuft of setæ at the tip. The appendix interna reaches not quite halfway along the appendix masculina.

While this species appears to be closely related to *Processa canaliculata* and *P. edulis* it differs in several features from both. The chief differences are given in the table on p. 409. The difference in the larva is very striking. Whilst *P. canaliculata* and *P. edulis* have exactly the same type of larva, so much so that it is difficult to distinguish them except for colour, size, and the presence or absence of dorso-lateral spines on the fourth abdominal somite, the present species has a larva with characters more of the type of the larval genus *Hectarthropus* Bate, being conspicuously broad and flattened dorso-ventrally, with long rostrum and conspicuous carapace spines. No female has as yet been found.

Processa larva allied to P. canaliculata.—The larva recorded by Gurney (1936 a) and called by him *Processa* B (*P. bermudensis* being A) has the form of a larval *P. canaliculata* with a pair of dorso-lateral spines on the fourth abdominal somite as in that species, and otherwise resembling it in structure. Although, however, the general features agree, it seems probable that it is a different but closely related species having the following characters. The descriptions are taken from specimens and notes kindly supplied by Dr. Gurney.

Stage I.—Length 1.55 mm. Very rich colouring, dark olive-brown chromatophores. A pair of dorso-lateral spines present on abdominal somites 4 and 5.

Differences between the three Species.

	<i>P. canaliculata.</i>	<i>P. edulis.</i>	<i>P. wheeleri</i> (♂ only).
Position of meso-carpal bend in second leg.	Left usually halfway along eye, seldom beyond eye, right a long way past antennal scale.	Left always beyond eye, usually halfway along antennal scale, right up to or slightly beyond antennal scale.	Left about halfway along eye, right up to about a third of antennal scale.
Relative length of carpus to propodus in 4th leg.	Carpus twice length of propodus.	Carpus less than twice length of propodus.	Carpus less than twice length of propodus.
3rd and 4th legs	In ♂ very slender, merus with seven very long and thin spines.	In ♂ very slender, merus with five to six very long and thin spines.	Not specially slender, merus with five not very thin spines.
5th leg	Propodus with two pairs of long thin spines far apart and a pair of long spines just before dactylus. Carpus longer than propodus.	Propodus with several short spines close together at distal end, no long spines just before dactylus. Carpus shorter than propodus.	Propodus with five long spines at regular intervals, no long spines just before dactylus. (Carpus and propodus equal.
5th abdominal somite..	No spine at angle.	Spine at angle.	No spines at angle.
Anterior margin of antennular stylocerite.	Curved.	Much curved.	Nearly straight.
Appendix masculina ..	Broad, bluntly rounded at end.	Broad across centre, pointed.	Faintly slender for its whole length, pointed.

Stage II.—Same colouring. Length 1.81 mm.

Stage IV?.—Length 2.7 mm. Same colouring. No pleopods. Exopods of maxillipede 2 and 3 with six setæ, of leg 2 seven setæ, of leg 3 six setæ. Leg 4 with a small exopod with three setæ. Leg 5 very small.

Stage I?.—Same colouring. Length 3.65 mm. Legs long but not chelate. Exopods of maxillipede 3 with six setæ, of legs 1, 2, and 3 with eight setæ, of leg 4 with six setæ.

Stages VI to VIII?.—Same colouring. These are all very much of a size, lengths 3.7, 3.8, and 3.9 mm., but they represent a series with gradually lengthening appendages, the last almost certainly representing stage VIII and comparable to that stage in the other known larval series of the genus. It is probable that the post-larva could emerge from this stage, as is shown for *P. edulis* (see Lebour, 1936 b). These three larvæ all have the exopods on legs 1–3 with eight setæ.

These larvæ differ from those of *P. canaliculata* in the colour (olive-brown instead of orange and yellow, with a slight trace only of brown), in size (the first larva 1.55, Stage VIII? 3.9 mm., whilst the first stage in *P. canaliculata* measures 2 mm., and Stage VIII at least 7 mm.), and in the number of setæ on the exopods of legs 1–3 in the later stages (never more than eight in Stage VIII, in *P. canaliculata* 12, 10, 8 to 12, 10, 10).

Processa bermudensis (Rankin). (Figs. 28–33.)

Two males were obtained in 1938 and a large number of females. As Gurney (1936 a) had only one female a few additional notes are added here and a description of the male.

The male and female are much alike, but the male is smaller, the two specimens measuring 14 and 16 mm. in length. The rostrum in both males and females has the upper lobe shorter than the lower. In Gurney's specimen the lobes are equal. Only in one cast skin were the lobes found to be equal, and in the moulted form they were again unequal. The propodus of the fifth leg in both male and female is armed with a spine and tufts of setæ just before the dactyl and one slightly further away from this, but in all examined except in Gurney's specimen there are at least three spines on the propodus,

one near the dactyl and two along the segment at almost equal intervals from the dactyl. In some cases there were four spines and in one instance there were five, the proximal spine being very small.

Description of the male.—The legs are not modified and agree with the female. The antennule has the external flagellum thickly armed with bundles of æsthetes beginning much nearer the base than in the female. The merocarpal bend of the right second leg does not reach to the end of the antennal scale. The first pleopod has the endopod pointed as in the figure, with setæ round the point; the second has a long appendix masculina, with one long, curved, serrated seta at the tip and four simple setæ, one long spine just above these, and three fine spines on the margin nearest the endopod reaching rather more than halfway up. Both the specimens were the same in the structure of the pleopods, which are probably of the adult type.

Besides the larvæ of *P. bermudensis*, which are extremely common in the plankton, the brighter coloured form is found which agrees in size and structure, having exopods only on legs 1–3, armed with eight setæ, and no exopod on leg 4 and no dorso-lateral spines on the fourth abdominal somite. The difference in colouring is very striking, this form having a deep yellow body with bright red chromatophores giving the appearance of a brilliant burnt sienna, whilst the larva of *P. bermudensis* has pale brown and glistening white chromatophores, the whole body being very pale. It seems probable that they are distinct species.

Dr. F. A. Chace has kindly allowed me to see two specimens of *Processa* which he obtained in Bermuda. One of these is *P. bermudensis*, but the other, a very small specimen, is a female of a new species which may possibly correspond to the small larva referred to above which closely resembles *P. bermudensis* but is of a bright brown colour.

II. LARVÆ OF THE AXIID-CALLIANASSID GROUP FROM BERMUDA.

Gurney (1938 c) describes a number of larvæ belonging to the group which he names the Axiid-Callianassid group. Several of these were afterwards obtained at

Bermuda, and it has been possible to place one of these in its systematic position. This is Gurney's Larva D I, the last larva of which changed to a post-larva in the Laboratory, and could be identified as an Axiid belonging to the genus *Axiopsis*, subgenus *Paraxiopsis*. Gurney is therefore abundantly justified in placing this larva and its relatives in the Axiidæ, and the proof that it belongs to this family carries us a good step forward in the elucidation of the larvæ. Moreover, it is now shown definitely that D I has nothing whatever to do with *Enoplometopus*, found with it in the 'Discovery' material, although the larvæ are curiously alike, as Gurney notes in his description. He is of the opinion that all species in Group I (having epipods, and with an exopod on leg 5) probably belong to the Axiidæ, and these all have four pairs of pleopods. Of this group I have obtained from Bermuda four species in the late larval stage, corresponding to Gurney's D I, B.R. II, B.R. III, and D VI. There is a complete series of B.R. III from the first larva to about the eighth. The eighth is probably the penultimate one and might turn into the post-larva; therefore here there seem to be the usual series of larval stages. It is probable that it is the same for all the species in this group which do not have an abbreviated development such as is present in *Axius stirhynchus*. It may well be that all the species of *Axius* proper have an abbreviated development, and that many of the other genera have the usual long series of larval stages. Four early stages belonging to the Axiid-Callianassid group were also obtained, one of which belongs to B.R. III, the others cannot be even approximately placed. Besides these there were late larvæ corresponding to Gurney's D X and D XIII belonging to Gurney's group II A and B, lacking epipods and having four and three pairs of pleopods respectively. D XIII is, except for these characters, strikingly like D I, and it is almost impossible to believe that D X and D XIII are not Axiids. Gurney's suggestion that D XIII might later develop a fourth pair of pleopods, and thus be identical with D X, is disproved, as the Bermudan specimens, which must be closely related to D XIII, if not identical, have no such pleopod in the last larva. It seems that the absence of epipods and of the fourth pair of pleopods are characters of less systematic importance than might be supposed, but that

the presence of an exopod on the fifth leg is of great importance, and probably distinguishes the Axiidæ from the Callianassidæ.

No species of the Axiidæ is so far known from Bermuda, and only one of the Callianassidæ, *Glypturus branneri* M. J. Rathbun, regarded by de Man (1925) as a *Callianassa*. We obtained several specimens of this species by digging on St. David's Island, the locality in which the first Bermudan specimens were obtained by Bean (see Verrill, 1922). These were not breeding in July when they were taken. Bathers from the Station jetty when diving saw, presumably, a Callianassid burrowing in the mud, but were unable to catch it. All the other larvæ were taken in the outside waters.

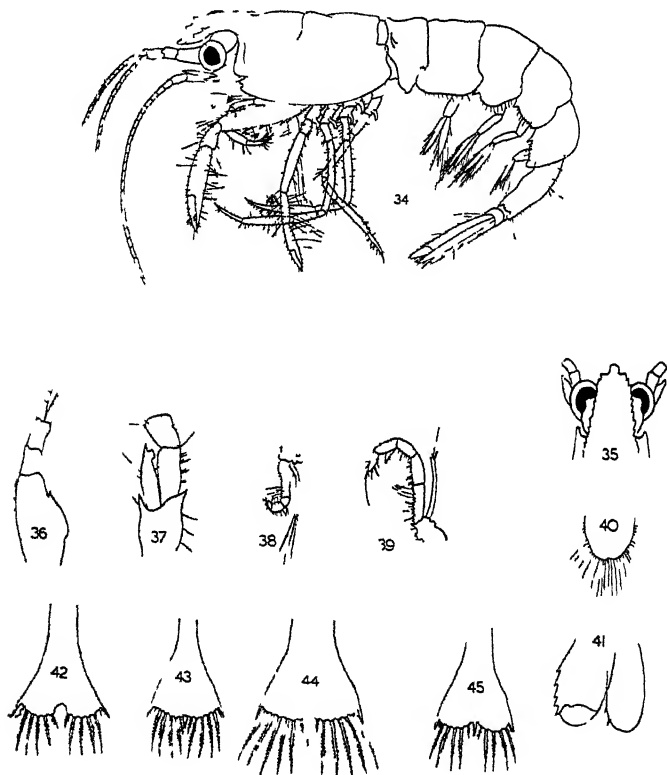
From the foregoing remarks it is shown that there must be several adults of the Axiid-Callianassid group yet to be found in Bermuda. Four at least of these belong to the Axiidæ, as distinguished by the presence of epipods on the legs, an exopod on the fifth leg, and four pairs of pleopods, one of them having been identified as belonging to *Axiopsis* subgenus *Paraxiopsis*. The remainder, two last larvæ and three early larvæ, are still not distinguishable, although the last larvæ probably belong to the Axiidæ and the early larvæ may belong to some of the later stages. Six species at least must be in the neighbourhood, probably burrowing in those regions which are difficult to reach with the dredge.

Species I (Gurney's D I).

AXIOPSIS, subgenus PARAXIOPSIS. (Figs. 34-41.)

Gurney (1938 c) has described the late larva of this species in detail. These specimens were obtained from the 'Discovery' material from the Atlantic as far north as 14° 39' N., and off the east coast of Africa to 6° 05' N. Also from the "Atlantis" station 1121, 35° 53' N., 62° 45' W. Live specimens were collected by the 'Culver' off Bermuda in 1938 and 1939 in the outside waters a few miles from land at a depth of from 100 to 500 metres. These correspond exactly with Gurney's description except for the fact that the small spines on the telson vary considerably. He gives the spine-formula as 13.1.13, there being nine small spines between the fourth large spine and the central one, whilst the Bermudan

specimens varied from 15.1.15 to 12.1.12, there being 11, 10, 9 or 8 small spines on each side of the central spine, 10 being the usual number; occasionally, there are 8 on one side and 9 on the other. Of 19 specimens examined 10 had a formula of 14.1.14, three of 15.1.15,



Arxiopsis, subgenus *Paraxiopsis*.

- Fig. 34.—Post-larva of Species I, 9 mm. long, moulting from last larva.
 Fig. 35.—Anterior part of head-region.
 Fig. 36.—Antennule
 Fig. 37.—Antenna.
 Fig. 38.—Second maxillipede.
 Fig. 39.—Third maxillipede.
 Fig. 40.—Telson.
 Fig. 41.—Uropods.
 Fig. 42.—Telson of early larva A, first stage.
 Fig. 43.—Telson of early larva B, first stage.
 Fig. 44.—Telson of early larva C, second stage.
 Fig. 45.—Telson of early larva D, first stage.

two of 13.1.13, one of 12.1.12 and three of 12.1.13. One with the formula 14.1.14 changed to a post-larva, recognizable as *Axiopsis*, subgenus *Paraxiopsis* sp., in the Laboratory. The only other difference from D I of any importance was the presence of six setæ on the exopod of the fifth leg, there being two in Gurney's drawing (fig. 6) *. The larva which changed to post-larva was in a later stage than his, but another, only slightly later than his and very like it, was ready to change into a post-larva, the form of the post-larval telson showing under the larval cuticle. Evidently the post-larva may emerge from the last larva in different stages. The latest stage has much longer pleopods and more strongly marked chelæ, the antennular and antennal flagella being longer. The youngest stage seen which had no pleopods differed very little in form from the later stages and had a similar telson. There are probably about three or four stages between this and the latest, making nine in all.

All the larvæ seen alive were very transparent and colourless except for bright red patches in the front thoracic region, near the end of the telson, at the bases of the legs, and on the tip of the rostrum. The last stage was very little longer than Gurney's specimens, ca. 16 mm. (rostrum 5 mm., body 11 mm.) in length.

The Post-larva.—This was obtained in the Laboratory from the last larva, May 28th, 1939, which was kept alive in a glass bowl. It measured 9 mm. in length and was perfectly colourless and transparent except for a row of red clusters of chromatophores at the base of legs 1 to 4. It is identified as belonging to the genus *Axiopsis* from the transverse suture on the outer ramus of the uropods, the back being flat and the hinder part of the carapace rounded and not carinate, and as belonging to the subgenus *Paraxiopsis* because the rostrum slopes down anteriorly and is not continuous with the gastric region, the antennal spine being very small (see de Man, 1925). In accordance with the characters of the genus there are no pleurobranchs; in *Axius*, in which they are present, they do not appear (according to Gurney, 1924) in the post-larva. There are epipods on legs 1 to 4 and two long arthrobranchs, and there are remains of exopods on all the legs. The rostrum reaches slightly beyond the eyes

* Which, he tells me, probably indicates that there were four.

and is excavated dorsally, with a slightly upturned tip, and edged with teeth. The pleura of the first abdominal somite are pointed and there is a hook on each side dorso-laterally. There is no pleopod on the first somite, but these are present on somites 2-5. Somites 3 to 5 have an anterior ventral tooth on the pleura. The telson is rounded, with a slight median indentation and central tooth, and bears three pairs of lateral spines and long setæ round the margin. The rami of the uropods are toothed on the outside margin, the outer ramus being divided near the tip. The antennule has a small tooth on the somewhat expanded proximal segment, the flagella being about half the length of the carapace, one slightly shorter than the other. The antenna has a small scale, though this is much abbreviated, with a small inner knob near the pointed tip, and is armed with one internal and two external setæ. The inner and outer spines on the base are very short. The third maxillipede is short, with a forwardly directed exopod bearing eight setæ, the two proximal segments of the endopod being toothed all along the margin. The first legs are subequal, the left slightly larger than the right, the ischium having four teeth, the merus four on the under margin, the ischium one tooth on the upper margin. The carpus is very short and the chela simple, the propodus being nearly double the length of the chela. The second leg is slightly shorter than the first, having three teeth on the under margin of the ischium, the carpus about equal in length, with the propodus and the chelæ only slightly shorter. The third, fourth, and fifth legs end in pointed dactyls, that of the fourth being armed with teeth along the upper margin. The pleopods have an appendix interna.

Although it is not possible to determine the species of this post-larval *Axiopsis*, one cannot help being struck by the resemblance of the first leg to Rathbun's (1901) figure of *Axius defensus* from Porto Rico which Borradaile (doubtfully 1903) and Schmitt (1935) have transferred to the genus *Axiopsis* and Schmitt to the subgenus *Paraxiopsis*, although the rostrum and antennæ are very different. As this is the only species of the subgenus known from the West Indies it is just possible that *Paraxiopsis defensus* is the adult of larva D I and that the young go through much change before reaching the structure of the full-grown form.

Species II (Gurney's B.R. II).

One damaged specimen only was obtained, apparently a last larval stage, rather later than Gurney's. The only way in which it differs from B.R. II is in the fifth leg, which bears a conspicuous exopod armed with four setæ instead of a minute one without setæ.

Species III (Gurney's D VI).

Two specimens only were obtained. One is at about the same stage as D VI (fig. 13) and the second is slightly younger. The pleura of somites 3 to 5 are slightly less rounded than in Gurney's description.

Species IV (Gurney's B.R. III).

This species was taken fairly commonly, and a complete series of larvæ from the first to the eighth or ninth was obtained. The tip of the rostrum and the tip of the central spine (which is very large) are bright red, even when preserved. The exopod of the fifth leg bears six setæ (5 in B.R. III). The specimens were obtained from 100 to 200 metres.

Stage I has a triangular telson with the usual 14 spines and a conspicuous central spine. Stage II is similar, but with 16 spines. Stage III is like Gurney's fig (17 c), and Stages IV to VIII or IX are alike in the elongated telson.

Species V (Gurney's D X).

One specimen only was obtained, a last larva, later than Gurney's but about the same length, the pleopods being longer. The exopod of the fifth leg is more developed and bears four setæ.

Species VI (similar to Gurney's D XIII,
but probably a different species).

Only a few specimens were obtained; they are in later stages than Gurney's, probably the last, and are 14 mm. long. There are only three pairs of pleopods, and it is thus certain that they are not identical with D X as was suggested by Gurney as a possibility. The abdominal somites are rounded. The exopod of the fifth leg bears two setæ. The telson formula is 11 . 1 . 11. At first sight this species is very like D I (species I which
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changed to an *Axiopsis*, subgenus *Paraxiopsis*), but it differs in its lack of epipods, in having only three pairs of pleopods, and in the telson formula.

Besides these advanced larvæ there are four types of early stages, which I have called A, B, C, and D. Of these one is the early stage of species IV, showing that the type with the first larva with a central spine and seven each side may be an Axiid. Of the other three two have a central spine on the telson besides 14 (or 16 in Stage II) spines, a large dorsal spine on the second abdominal somite, and a small dorsal spine on somites 3-5. One of these has sharply pointed dorsal spines and in the other they are bluntly rounded. The fourth species differs from the others in having no central spine on the telson. Otherwise it is like the others and has a large dorsal spine on somite 2 and small dorsal spines on 3-5. All have the usual long rostrum, more or less serrated along the edges or tip. In most respects they resemble the ordinary *Callinassa* larva (except D) except for the fact that one of them has no central spine on the telson. This last species was the only one obtained in the Reach plankton, and probably belongs to an inshore form. Species D shows that the final 8.1.8 telson formula can be interpreted as the transformation of the outer four spines, including the hair-like second, into the four outer large lateral spines of the telson A type of Gurney. It is probable that these four outer spines in all the species have a similar origin and that the extra small spines in those with a higher formula are formed between the central spine and the fourth outside one. Whether these extra spines are present in the first larva it is not possible to say, but it may be that one of the two first stages noted here with a central spine on the telson and with dorsal abdominal spines belongs to one of the Axiids with a higher spine-formula or to one of those with 8.1.8 spine-formula recorded here.

Early Larval Stages.

Species A (fig. 9).—Obtained in plankton from the Reach at night. First stage only, 2.9 mm. long. This species is very transparent when alive, with a mass of bright red pigment in the thorax behind the mouth-region and a small amount of red in front and dorsally, with pale yellow above. The long and narrow rostrum projects

beyond the eye for as much as the eye-length. It is armed at the tip only with serrations. The carapace is denticulated in the front ventral margin. The second abdominal somite bears a long dorsal spine, not quite so long as the third somite; somites 3 to 5 bear small dorsal spines. The telson is strongly indented in the centre and bears 7+7 spines, there being no central spine. The antennal flagellum bears three terminal setæ. The exopods of the second and third maxillipedes bear six terminal setæ.

This larva is specially interesting as it combines the usual Axiid-Callianassid form with the absence of a central spine on the telson.

Species B (fig. 10).—Obtained in the outside plankton. First stage only. Length 3.4 mm. This species resembles A in form but has a central spine on the telson. The rostrum is rather longer, but is also armed with serrations only at the tip. The spines on the abdomen are similar and the antennal flagellum bears three setæ. The exopods of the maxillipedes bear 4, 5, 4 setæ. Gurney obtained this species just outside in Castle Roads in characteristically inshore plankton. His specimens had a strikingly large second spine on the telson. He regards this as probably belonging to *Glypturus branneri*.

Species C (fig. 11).—Obtained in the outside waters. Second stage only. Length 4.2 mm. This species is like B in its telson, but although the dorsal spines are present on the abdomen they are peculiarly blunt and compressed. The rostrum has only a faint suggestion of serrations anteriorly. The exopods of the maxillipedes bear 4, 5, 5 setæ.

Species D (fig. 12).—This is an early stage of species IV, which has no dorsal spine on the second abdominal somite but has paired spines on 4 and 5. The first stage, length 3.7 mm., has a telson like B and C. The rostrum projects beyond the eyes for about the eye-length and has very inconspicuous serrations. The exopods of the maxillipedes bear 4, 5, 5 setæ.

There are, as is shown above, six late larvæ of the Axiid-Callianassid group found in Bermudan waters and four early larvæ, only one of which is certainly identical with one of the six late stages. Of this group

only one Callianassid has been recorded from Bermuda, *Glypturus branneri*, and almost certainly one of the early stages found, belongs to this species, probably B. The remaining two early stages probably belong to two of the remaining five late larvæ. These are all Axiids (3) or they belong to the Group II of Gurney, which are very difficult to place, having no epipods. D X (species V) has four pairs of pleopods and D XIII (allied to or identical with species VI) has three pairs. Both have the exopod of the fifth leg present but reduced. In the Bermudan specimens, however, this is not so reduced as in Gurney's forms. It is shown above that these are separate species. They are so like those of Group I, except for the presence of epipods, that it seems more likely that they are Axiids rather than Callianassids; if so, and the early larvæ belong to any of these, it shows still more clearly that the two groups are closely related, and supports all Gurney's arguments in favour of this view.

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XXVII.—Notes on the Plectognath Fishes.—V. The Families of Triacanthiform Fishes, with a Synopsis of the Genera and Description of a new Species. By A. FRASER-BRUNNER.

HITHERTO the fishes belonging to the genera *Triacanthus*, *Triacanthodes*, *Tydemania*, *Halimochirus*, and a few others of more recent discovery, have been considered to represent a single family. Myers, whose analysis

of these forms is the most valuable to date *, recognized three subfamilies—the Triacanthodinæ, Halimochirurginæ, and Triacanthinæ—and upon external characters this is as far as it would be reasonable to go in dividing them.

However, through the very generous assistance of Professor Myers, and the kind co-operation of the authorities at the United States National Museum, I have had the opportunity not only to examine nearly all the known species of the rare Triacanthodid and Halimochirurgid groups, but also to prepare skeletons of some of them. In addition, Dr. Myers has provided me with various special data and photographs, for which I am greatly indebted.

As a result, I am now able to show that these rare forms represent a family distinct from the better known Triacanthidæ. *Triacanthodes* being the earliest known of the genera, the new family should be called the Triacanthodidæ. It will not be necessary for the purpose of the present paper to enter into a full account of the anatomy of these groups, but it may be remarked in passing that the study of the skeleton of such a form as *Johnsonina* sheds great light on the origin of the Plectognathi in general. The Triacanthodidæ, despite the eccentricities of such forms as *Halimochirurgus*, proves to be the least specialized family of Plectognath fishes, and therefore provides the most reliable guide to the relationships of the order. I intend giving an elaborate treatment of these matters in a forthcoming work.

For the present I propose simply to give the distinguishing characters of the two families, which together may be regarded as constituting a division Triacanthiformes of the suborder Balistoidea.

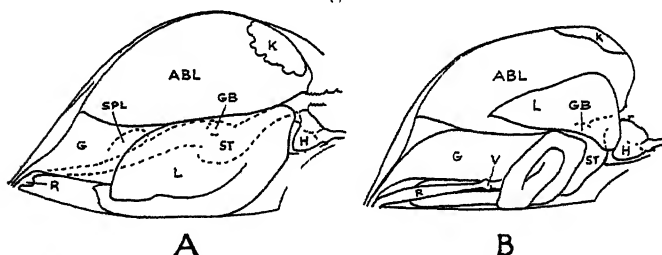
The Triacanthiformes are Plectognathi having the premaxillaries protractile and free from the maxillaries, separate teeth, immovable palatine, a distinct nasal pit, preorbital not ossified, epipleurals present, spinous dorsal fin more or less developed, pelvis present, separate pelvic fins represented each by one large spine and occasionally a small soft ray, body covered with small scales which do not overlap.

* Myers, 1934, Smithsonian Misc. Coll. xci. no. 9, pp. 4-10.

The following are the main characters by which the families are distinguishable :—

- I. Supraoccipital well forward, hind part of cranial roof formed by exoccipitals; a high thin supraoccipital crest; frontals extending forward to meet premaxillary pedicels (when mouth is closed); skull set straight on vertebral column. Precaudal vertebrae with epipleurals from the 2nd. Liver below air-bladder; intestine straight; rectum very short, bulbous, without evident valve. Caudal peduncle short; caudal fin rounded TRIACANTHODIDÆ.
- II. Hind part of cranial roof formed by supraoccipital, which is elevated, but without crest; exoccipitals confined to back of skull; frontals not reaching forward to meet premaxillary pedicels; skull bent downward in relation to vertebral column. Precaudal vertebrae with epipleurals from the 4th. Liver beside air-bladder; intestine looped 2 or 3 times; rectum long and straight, divided from intestine by a muscular valve. Caudal peduncle long; caudal fin forked TRIACANTHIDÆ.

Fig. 1.

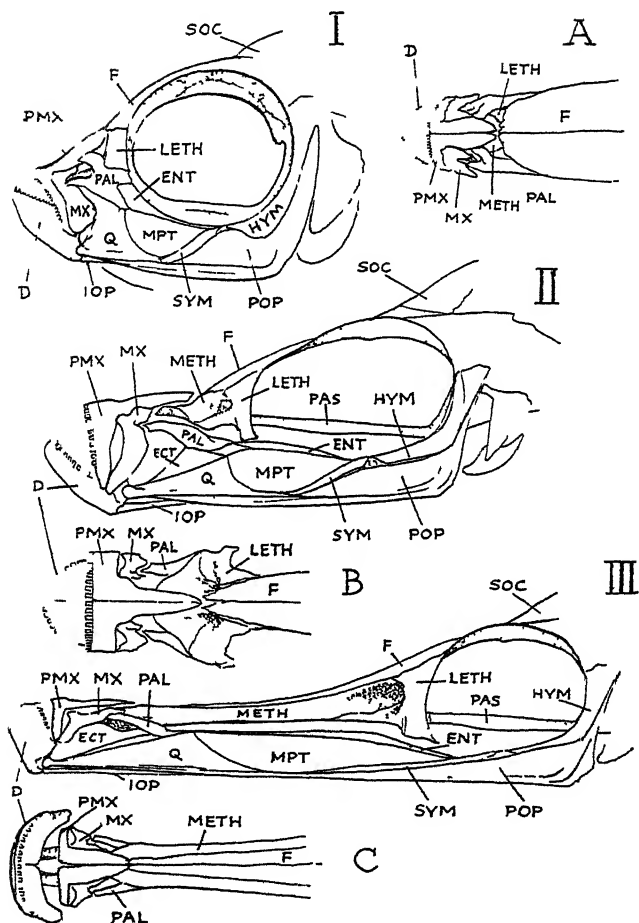


Arrangement of the principle organs in the body cavity of A, Triacanthodidæ; and B, Triacanthidæ; ABL, Air-bladder; G, gonad; GB, gall-bladder; H, heart; K, kidney; L, liver; R, rectum; SPL, spleen; ST, stomach; V, valve. (Diagrammatic.)

Family 1. Triacanthodidæ.

I have not found it possible to divide the Triacanthodidæ into subfamilies. Apart from minor peculiarities in certain genera they present a fairly complete series, ranging from the least specialized types, such as *Triacanthodes*, or the short-snouted, many-toothed *Johnsonina* with its well-developed spinous dorsal fin, through *Bathypylax* and *Tydemania* to the long-snouted forms with reduced spinous dorsal fins and modified dentition, *Halimochirurgus* and *Macrorhamphosodes*. The elongate, tube-like snout in the latter genus differs from that of the

Fig. 2.



Semi-diagrammatic sketches of skulls of I, *Johnsonina*; A, antorbital part of same, upper view; II, *Tydemania*; B, antorbital part of same, upper view; III, *Macrorhamphosodes*; C, snout of same, upper view. D, dentary; ECT, ectopterygoid; ENT, entopterygoid; F, frontal; HYM, hyomandibular; IOP, interoperculum; LETH, lateral ethmoid; METH, mesethmoid; MPT, metapterygoid; MX, maxillary; PAL, palatine; PAS, parasphenoid; PMX, premaxillary; POP, preoperculum; Q, quadrate; SOC, supraoccipital; SYM, symplectic.

more generalized forms only in shape, the bones of the ethmoid and pterygo-quadrato region being greatly elongate, but bearing the same relation to one another (fig. 2).

The following key to the genera takes into account several characters not previously used for this group, and seems to me to express fairly well their probable relationships:—

Key to the Genera of Triacanthodidæ.

- I. Dorsal spines 6, the 5th and 6th sometimes minute and inconspicuous. Snout not greatly prolonged. Origin of anal well behind that of soft dorsal.
 - A. Teeth conical. Mouth terminal or subdorsal. Lips moderate or thin. Interorbital space convex, orbital ridges not prominent. Lateral line inconspicuous. Form short and deep.
 1. Pelvis broad and flat, depressed. Distal ends of first dorsal and pelvic spine smooth, grooved, barbs or asperities when present confined to basal part. Membrane of spinous dorsal not scaly.
 - a. Gill-openings wide, extending well below middle of pectoral base; pseudobranchiæ extending well below upper half of opercular wall. Scales short, each with 3 denticles. About 14 teeth in upper jaw, 20 to 24 in lower 1. *Triacanthodes*.
 - b. Gill-openings small, not extending below middle of pectoral base; pseudobranchiæ restricted to upper half of opercular wall.
 - i. Scales very deep and narrow, each with about 11 small denticles. Teeth minute, about 40 in each jaw 2. *Johnsonina*.
 - ii. Scales moderately deep, each with 5 or 6 denticles of varying strength.
 - * About 10 teeth in each jaw. Greatest width of pelvis contained more than 3 times in its length. Snout short 3. *Paratriacanthodes*.
 - ** About 20 teeth in upper jaw, 28 in lower. Greatest width of pelvis contained only $2\frac{1}{2}$ times in its length. Snout slightly tubular 4. *Bathyphylax*.

2. Pelvis narrow and compressed.
First dorsal and pelvic spines completely covered with asperites like those on body. Each scale with 3 denticles, the middle one strongest.
 - a. Outer series of 10 teeth in upper jaw, 12 in lower; an inner series of 2 in both jaws. Membrane of spinous dorsal without scales. Bases of pelvic spines closely apposed. Pelvis not tapering posteriorly 5. *Parahollandia*.
 - b. 14 teeth in upper jaw, 16 in lower; no inner series. Membrane of spinous dorsal scaly. Bases of pelvic spines with a wide space between. Pelvis tapering to a point posteriorly. 6. *Hollandia*.
- B. Teeth truncated. Mouth dorsal. Lips very thick. Snout somewhat tubular. Interorbital space concave, orbital ridges prominent. Lateral line conspicuous, each pore with a coronet of denticles. Form rather elongate. Gill-openings restricted; pseudobranchiæ confined to upper half of opercular wall. Greatest width of pelvis contained more than 3 times in length 7. *Tydemania*.
- II. Dorsal spines 2 or 3. Snout much prolonged, tube-like. Mouth dorsal. Origin of anal fin opposite that of soft dorsal. Lateral line inconspicuous.
 - A. Teeth present in both jaws, conical. Lips not greatly flattened. Gill-openings small, not reaching below middle of pectoral base 8. *Halimochirurgus*.
 - B. Teeth in lower jaw only, truncate and flattened. Lips forming a wide, sucker-like disc. Gill-openings reaching below pectoral base 9. *Macrorhamphosodes*.

Genus 1. TRIACANTHODES Bleeker, 1857.

Genotype: *Triacanthus anomalus* Temminck and Schlegel, 1850.

Other species: *T. æthiops* Alcock, 1899.

I have studied the anatomy of *T. anomalus*.

Genus 2. JOHNSONINA Myers, 1934.

Genotype: *Johnsonina eriomma* Myers, 1934.

I have studied the anatomy of this fish.

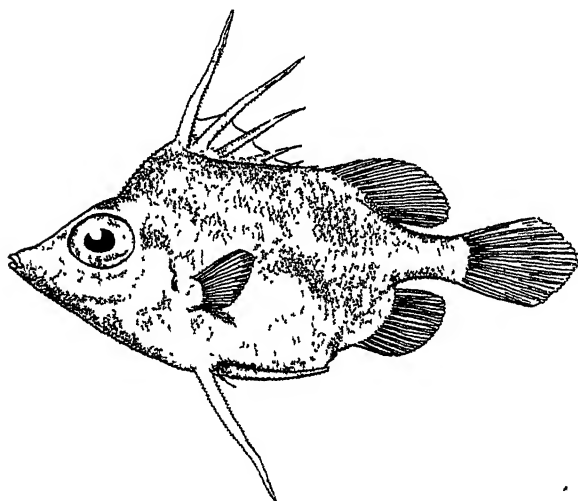
Genus 3. PARATRIACANTHODES Fowler, 1931.

Genotype : *Paratriacanthodes retrospinis* Fowler, 1931.Other species : *P. herrei* Myers, 1934.

I have studied the skeleton of this species.

Paratriacanthodes myersi. sp. n.

Depth of body contained twice in the length, length of head 3 times. Diameter of eye contained $2\frac{1}{2}$ times in length of head. Interorbital width $\frac{2}{3}$ diameter of eye. Distance from base of first dorsal spine to nearest point

*Paratriacanthodes myersi*. Holotype ($\times \frac{6}{7}$.)

on orbit contained $1\frac{1}{2}$ times in length of head. Width of gill-opening half diameter of eye. Length of caudal peduncle half length of head.

Dorsal spines 6, the last deeply imbedded, the membranes without scales. Basal two-thirds of anterior dorsal spines with small asperities, somewhat enlarged as regular series on lateral edges; the ends of the spines naked and grooved longitudinally. Soft dorsal fin with 15 rays; anal fin with 13 rays, commencing at the vertical form middle of soft dorsal. Pectoral 15. Pelvic spines

with asperites on basal two-thirds and grooved at distal ends, like the first dorsal spine; a single small soft ray in the axil of each. Dermal face of pelvis moderately broad, its greatest width contained $4\frac{1}{2}$ times in its length, which measures $1\frac{1}{8}$ times in length of head. Scales like those of *P. herrei*, but larger, with stronger denticles.

Colour in spirits: pale orange-brown.

Hab. Kai Island (East Indies). 129 fathoms.

Described from the single specimen 68 mm. long, collected during the 'Challenger' Expedition, and incorrectly identified as *Triacanthodes anomalus*, under which name it has remained in the British Museum (Nat. Hist.) since 1879. Its registered number is B.M.N.H.79.5.4.572.

This species is closely related to *P. herrei*, differing mainly in shape and certain proportions, the dorsum being higher, the anterior profile more declivous, the interorbital space narrower, etc., and in having more pectoral rays (only 12-13 in *P. herrei*). I name it after my friend, Professor George S. Myers, in recognition of his fine work on this group.

Two subgenera are recognizable here, defined thus:—

- I. Dorsal and pelvic spines without strong retrorse barbs; pelvic spines separated by space $1\frac{1}{2}$ times diameter of one of the spines... Subgen. *Triradulifer*, nov.
(Type *Paratriacanthodes herrei* Myers).
- II. Dorsal and pelvic spines with strong retrorse barbs; pelvic spines separated by space 3 times diameter of one of the spines..... Subgen. *Paratriacanthodes*
Fowler (Type *P. retrospinis* Fowler).

Genus 4. BATHYPHYLAX Myers, 1934.

Genotype: *Bathyphylax bombifrons* Myers, 1934.

This species forms a link between *Triacanthodes* and *Tydemania*. There are six dorsal spines, but the last two are minute. Dr. Myers stated "Dorsal with 4 spines, 2 small imbedded spines between the two fins . . .", but at my request he re-examined the type and confirmed my suggestion that the two imbedded spines are true fin-rays.

Genus 5. PARAHOLLARDIA, nov.

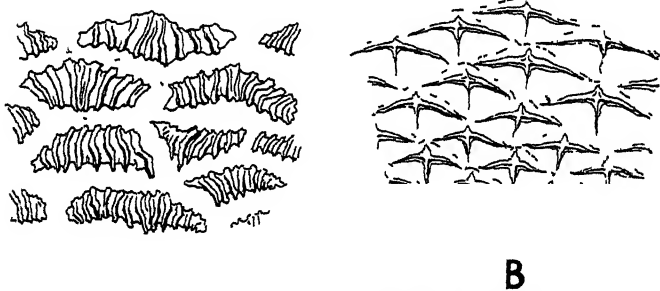
Form very deep and compressed; dorsum high. Spinous dorsal fin well developed, with 6 rays, covered

with integument to their tips; the membrane without scales. Pelvis narrow and compressed, not pointed posteriorly, the bases of the pelvic spines closely apposed, the spines covered with integument to their tips. Snout short; mouth terminal; teeth conical, about 10 in each jaw. Scales coarse, each with 3 denticles. Gill-opening small.

Genotype: *Triacanthodes lineatus* Longley, 1935.

The type of this species was sent by Longley to the United States National Museum, and Dr. Myers generously sent me notes upon it, together with a photograph so clear that I have been able to determine the scale-characters by its means. It is evidently closely related

Fig. 4.



Scales from side of A, *Pseudotriacanthus strigilifer*,
and B, *Triacanthus rhodopterus*.

to *Hollardia*, but comparison with a specimen of the latter shows it to be sufficiently different to warrant a new genus.

This fish has been described a second time as *Triacanthodes zebra* Nichols and Firth, 1936. It is said to be fairly common in deep water off Tortugas, but so far no specimen has reached the British Museum.

Genus 6. HOLLARDIA Poey, 1861.

Genotype: *Hollardia hollardi* Poey, 1861.

I have had the privilege of examining one of the spirit specimens of this species, described by Breder (1925) and Myers (1934). There seems little doubt that it is

identical with Poey's species, the type of which was badly stuffed.

Genus 7. *TYDEMANIA* Weber, 1913.

Genotype : *Tydemania navigatoris* Weber, 1913.

This species, remarkable in the family for the well-marked lateral line, has six dorsal spines, but the last three are minute and difficult to find, so that it was originally stated to have but four, and Kamohara has recently credited it with only three. This reduction of the fin, together with the tubular snout and dorsal mouth, and the rather elongate form, approaches the *Macrorhamphosodes* type. I have examined the skeleton of this fish.

Genus 8. *HALIMOCHIRURGUS* Alcock, 1899.

Genotype : *Halimochirurgus centriscoides* Alcock, 1899.

Other species : *H. alcocki* Weber, 1913 (= *H. macraulos* Fowler, 1934) ; *H. triacanthus* Fowler, 1934.

I have compared one of Fowler's paratypes of *H. macraulos* with the type of *H. alcocki* received on loan from the Leiden Museum, and find them to be identical.

Genus 9. *MACRORHAMPHOSODES* Fowler, 1934.

Genotype : *Macrorhamphosodes platycheilus* Fowler, 1934 (= *Halimochirurgus uradoi* Kamohara, 1933).

I have studied the anatomy of *M. uradoi* (Kamohara).

Family 2. *Triacanthidae*.

This family is well represented in the British Museum collection, and in addition I have valuable material on loan from the Indian and Australian Museums. There are eight species, one of which is sufficiently different from the rest to be regarded as a separate genus, distinguished in the following manner :—

- I. Each scale with several transverse ridges. Tips of first dorsal and pelvic spines naked, smooth. Second dorsal spine more than half the length of the first, sometimes nearly equal to it. Lower half of spinous dorsal fin sheathed in scales. Base of anal fin only half as long as that of soft dorsal 1. *Pseudotriacanthus*.
- II. Each scale with a cruciform ridge. First dorsal and pelvic spines covered with integument to their tips. Second dorsal

spine not more than half length of first, usually much less. Spinous dorsal fin without scaly sheath. Base of anal fin more than half as long as that of soft dorsal 2. *Triacanthus*.

Genus 1. PSEUDOTRIACANTHUS, nov.

(Genotype: *Triacanthus strigilifer* Cantor, 1847.

Genus 2. TRIACANTHUS (Cuvier) Oken, 1817.

(Genotype: *Balistes biaculeatus* Bloch, 1785.

Other species: *T. blochii* Bleeker, 1852; *T. oxycephalus* Bleeker, 1852; *T. nieuhofti* Bleeker, 1852; *T. rhodopterus* Bleeker, 1852; *T. brevirostris* Schlegel, 1846; *T. weberi* Chaudhuri, 1910.

The last-mentioned species, *T. weberi*, differs from its congeners in its greatly compressed and pointed snout, its very small mouth, the reduction of the fifth dorsal spine, so that it appears to be absent, and the inconspicuous lateral line. It may be regarded as the type of a new sub-genus, for which I propose the name *Trixiphichthys*.

XXVIII.—*New Species of Staphylinidæ (Col.) from the Philippines.* By MALCOLM CAMERON, M.B., R.N., F.R.E.S.

TEN years ago I purchased from Messrs. Staudinger and Bang-Haas a collection of Staphylinidæ from the Philippines which had been examined by Dr. Max Bernhauer. Many of these were new and have now been described by that authority; of the others no descriptions have yet appeared, and in this paper I describe these species, retaining the manuscript names used by him.

OXYTELINÆ.

Thoracochirus helleri, sp. n. (Wendeler in litt.).

Black, rather shining, the antennal tubercles reddish yellow, the elytra often pitchy, the last abdominal tergite reddish. Antennæ and legs reddish yellow. Length 3.75 mm.

Size and colour of *nanus* Heller, but more shining, the head a little narrower, less punctured, the eyes slightly less prominent, thorax as broad as that of *nanus*, but

more convex, more finely and much less closely punctured, especially towards the sides, elytra a little shorter, more coarsely and less closely sculptured, abdomen less closely punctured. Clypeus scarcely punctured, along the anterior border with four or five small depressions; vertex sulcate, on each side with a few small verrucose punctures. Antennæ as in *nannus*. Thorax strongly transverse ($3.5:2$), rather convex, sulcate along the middle, with small verrucose sculpture not very close and much less close towards the sides. Elytra a little longer than the thorax ($2.75:2$), slightly broader than long, coarsely, rather closely and roughly punctured. Abdomen finely and rather sparingly punctured.

Aroroy; Panaon; Subaon; Dapa.

Phlæonomus (Phlæostiba) philippinus, sp. n. (Bernh.
in litt.).

Subdepressed, rather shining; head, thorax, and abdomen pitchy-brown, elytra yellow, with an oblique brown fascia occupying the postero-external region and extending to the apex of the suture. Antennæ with the first seven segments yellow, the following black. Legs yellow. Length 1.75 mm.

Head rather closely, finely, and obsoletely punctured, finely coriaceous. Antennæ rather long, the 3rd segment as long as the 2nd, 4th to 6th a little longer than broad, decreasing in length, the 6th narrower than the 5th, 7th about as long as broad, 8th transverse, 9th and 10th stouter and as long as broad. Thorax transverse ($3.75:2.5$), convex, widest at the middle, the sides evenly rounded and equally retracted in front and behind, the posterior angles rounded without impression, very finely and closely punctured, feebly coriaceous. Elytra longer than the thorax ($4:2.5$), slightly broader than long, finely, closely, and obsoletely punctured, feebly coriaceous. Abdomen closely, obsoletely punctured and feebly coriaceous.

Luzon: Imugan.

Phlæonomus (s. str.) alutaceus, sp. n. (Bernh.
in litt.).

Rather convex, moderately shining; head, thorax, and abdomen yellowish red; elytra yellow. Antennæ and legs reddish yellow. Length 2 mm.

Build of *apicalis* Cam., but a little larger and more robust, less shining, more brightly coloured, thorax more punctured. Head strongly coriaceous, almost impunctate. Antennæ with the 3rd to 5th segments longer than broad, decreasing in length, 6th moniliform, 7th slightly, 8th to 10th much more strongly transverse. Thorax nearly twice as broad as long, the sides rounded and equally retracted in front and behind, the posterior angles obtuse and without impression, less strongly coriaceous than the head, on the disc with some small obsolete punctures. Elytra twice as long as the thorax, as long as broad, finely, moderately closely, obsoletely punctured, coriaceous. Abdomen coriaceous, practically impunctate.

Luzon ; Imugan.

Phlaenonomus (s. str.) *flavicornis*, sp. n. (Bernh.
in litt.).

Subconvex, rather shining, yellowish red, the elytra reddish yellow obscurely infusate behind. Antennæ and legs reddish yellow. Length 1.5 mm.

Colour and build of *alutaceus*, but smaller, the thorax less transverse, more shining and less strongly coriaceous. Head practically impunctate, finely coriaceous. Antennæ as in *alutaceus*. Thorax more than a half broader than long, convex, without impressions, the posterior angles obtuse, finely coriaceous and with a few obsolete punctures. Elytra twice as long as the thorax, finely coriaceous and with moderately close, obsolete punctures. Abdomen coriaceous, practically impunctate.

Samar ; Catbalogan.

Trogophlæus (*Carpalimus*) *unipustulatus*, sp. n.
(Bernh. *in litt.*).

Colour and lustre of *pustulatus* Bernh., but larger and more robust, the antennæ with the 1st and last three segments reddish yellow, the whole insect covered with a long erect pubescence as in *lunatus* Motsch. Head less finely and less closely punctured than in *pustulatus*, thorax broader, rather sparingly and superficially punctured, elytra and abdomen more coarsely punctured. Length 3 mm.

Luzon ; Pagsanjan.

Oxytelus (Caccoporus) sublucidus, sp. n.
(Bernh. in litt.).

Shining; head black, the frontal margin reddish yellow; thorax dark reddish brown, lighter towards the sides, the extreme lateral and posterior margins black; elytra yellowish brown, more or less extensively infuscate on the disc; abdomen brownish yellow, darker along the middle. Antennæ reddish brown, the first four segments and legs reddish yellow. Length 3.5 mm.

♀: near *incisus* Motsch. (*ferrugineus* Kr.), but a little larger and distinctly more robust, the colour darker, the punctures of the head coarser, sulci of thorax less deep, more finely and more sparingly punctured, the elytra more finely punctate striate, antennæ stouter, but of similar structure, in other respects like *incisus*.

Mindanao; Momungan. Luzon; Buranen.

Oxytelus (Caccoporus) subincisus, sp. n.

Shining: head black, yellowish in front, thorax dark reddish brown, elytra yellowish brown, abdomen yellowish brown, the sides lighter. Antennæ red, the first three segments and legs reddish yellow. Length 3.75 mm.

♀: narrower and more elongate than *sublucidus* Cam., with narrower thorax and differently constructed antennæ which are longer and stouter, the penultimate segments as long as broad and scarcely differing in structure from *subsculptus* Cam. Head narrower than the thorax, the eyes very large and occupying the whole side of the head, the vertex sulcate, the clypeal region feebly coriaceous, elsewhere with moderately large and moderately close punctures. Antennæ long and stout, the 4th to 7th segments transverse, increasing in width, 8th to 10th as long as broad. Thorax transverse (3:2), the posterior angles obtuse, the sulci broader and deeper than in *incisus*, more impressed at the sides, more finely and much less closely punctured than in that species, elytra and abdomen scarcely differing in sculpture from it.

Luzon; Los Banos: Mt. Banahao.

Oxytelus (Anotylus) panaonensis, sp. n.

Head dark reddish brown, dull, the antennal tubercles. space between and clypeal region shining reddish yellow;

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thorax dull, reddish yellow, elytra dull, reddish brown; abdomen more shining, dark reddish brown. Antennæ black, the first four segments and legs reddish yellow. Length 1.2 mm.

♂? head subquadrate, broader than long (2.75:2), as broad as the thorax, eyes small, the vertex with three superficial sulci, the median one narrower than the lateral; the shining area impunctate, the rest of the surface strongly coriaceous and impunctate. Antennæ with the 4th segment small, slightly transverse, the 5th and following stouter, only slightly transverse, the 11th as long as the 9th and 10th together. Thorax transverse (2.75:2), trapezoidal, the disc rather superficially trisulcate, the median sulcus narrowest, the whole surface strongly coriaceous and impunctate; elytra a little longer and broader than the thorax, transverse, striate punctate; abdomen very finely and very sparingly punctured. The terminal sternites present no distinguishing characters

Panaon.

Bledius (Hesperophilus) parens, sp. n.

In build and colour scarcely differing from *birmanus* Cam. (? *helferi* Fauv.), but larger (3 mm.) and more robust, the punctures on the head larger, the antennæ of similar structure, but longer and stouter, thorax of similar build, but less shining, more strongly coriaceous, the punctures larger, more superficial, and more confused with the ground-sculpture; elytra a little longer, as long as broad, the puncturation as in *birmanus*; abdomen almost impunctate, shining.

Manila.

Bledius (Pucerus) albopubescens, sp. n.
(Bernh. in litt.).

In colour and lustre scarcely differing from *verres* Er. v. *monachus* Bernh., but smaller (3.75 mm.), the antennæ distinctly shorter, the intermediate segments shorter, the clypeal tubercles shorter and blunter, the antennal tubercles less elevated, the vertex with a fine short sulcus, the thorax with the sides rounded posteriorly. the puncturation less fine and less superficial, elytra shorter, thorax 2.5, elytra 3 (in *monachus* 2.5:4), the

sculpture scarcely differing and in other respects like *monachus*. The pubescence is short, white, and scanty. Manila.

Holotrochus philippinus, sp. n. (Bernh. in litt.).

Shining, pitchy, the head in front, the margins of the thorax indeterminately, and posterior margins of the tergites and apex of the abdomen yellowish red. Antennæ and legs yellowish red. Length 3 mm.

Near *glaberrimus* Cam. and *minutus* Cam. Smaller than the former, larger than the latter, and more brightly coloured than either, the puncturation of the head and thorax finer than in *minutus*. Head narrower than the thorax, very finely and sparingly punctured and without ground-sculpture. Antennæ short, stouter than in *minutus*, the penultimate segments nearly three times broader than long. Thorax transverse (2.5:1.75), the sides straight and parallel, the disc very finely, but moderately closely punctured, the sides almost impunctate; ground-sculpture absent. Elytra longer (2:1.75) than the thorax, as long as broad, very sparingly and very obsoletely punctured and without ground-sculpture. Abdomen extremely finely and very sparingly punctured and without ground-sculpture.

Luzon; Mt. Makiling; Balbalan

From Siargao; Dapa comes a form with practically impunctate head and thorax, subsp. *latus* n.

PÆDERINÆ.

Pinophilus coarcticollis, sp. n.

Greasy lustrous, pitchy brown, the posterior margins of the tergites narrowly, the 8th almost entirely reddish; under surface dark ferruginous red. Antennæ and legs yellowish red, the anterior coxæ pale yellow. Length 10 mm.

Remarkable in the shape of the thorax, which is cupuli-form. The sculpture of the head is similar in character to that of *bomfordi* Epp. Head as broad as the thorax, the eyes moderate, the temples very small, dentiform, the puncturation close, extending uniformly to the anterior border and without smooth spaces, umbilicate, of the same character, but coarser than in *bomfordi*. Antennæ

moderate, not reaching the posterior margin of the thorax, the penultimate segments moderately long and clavate. Thorax as long as broad, cupuliform, convex, widest just behind the anterior angles, the sides from there evenly and gently rounded and retracted backwards and coarctate with the base, before the scutellum with a short shining keel, the puncturation close, a little finer and much more superficial than on the head. Elytra as long and as broad as the thorax, longitudinally impressed on each side of the suture, closely, rather coarsely and deeply punctured. Abdomen finely and rather closely punctured and pubescent, the 7th tergite with fine membranous border, the fore parts with more scanty hairs.

♂: 6th sternite with a small triangular excision.
Mindoro; Subaan.

Palaminus flavoguttatus, sp. n. (Bernh. in litt.).

Shining ferruginous red, the head infusate between the eyes, the thorax along the middle; elytra pitchy black, with a large oval reddish yellow spot occupying the shoulder and anterior half externally, another oval extends obliquely from a little behind the middle of the suture towards the postero-external angle, the posterior margin also narrowly reddish yellow, there are thus four large markings on the elytra. Antennæ and legs yellow. Length 5 mm. (abdomen extended).

Head as broad as the thorax, the posterior angles minute, dentiform, the disc closely covered with rather large punctures. Antennæ long and slender, extending a little beyond the base of the elytra. Thorax transverse (2.5:2.1), the sides evenly and gently rounded and retracted behind, in the posterior half with distinct median keel, the disc closely covered with punctures like the head, the antero- and postero-external areas impunctate. Elytra twice as long as the thorax, more closely and less coarsely punctured, rugulose. Pubescence yellow, longer and coarser on the abdomen.

Luzon: Mt. Polis.

Astenus montanellus, sp. n. (Bernh. in litt.).

Black, elytra and abdomen more shining than the head and thorax, the abdomen with the posterior margin of the

last tergite obscurely yellow, the anal styles reddish yellow. Antennæ and legs reddish yellow, the 3rd and 4th segments of the former slightly infusate. Length 5 mm.

Very near *drescheri* Cam., the build of the head and thorax scarcely different, but with shorter elytra more strongly narrowed at the base. Head a little longer than broad, broader than the thorax, the eyes rather small, the postocular region completely coarctate with the base, the sculpture scarcely differing from that of *bispinus* Motsch. Antennæ long and slender, all the segments much longer than broad as in *drescheri*. Thorax longer than broad (3 : 2.5), oviform, the sculpture coarser than on the head and with some tendency at the sides to coalesce longitudinally, much less coarse than in either *bispinus* or *drescheri*. Elytra as long as the thorax, distinctly narrowed at the base and widened towards apex, coarsely and closely punctured, but not at all rugulose. Abdomen a little widened towards the apex, coarsely and closely punctured, more finely and rather more sparingly on the 5th visible tergite

♂ : unknown

Luzon : Mt. Polis.

Astenus frater, sp. n. (Bernh. in litt.).

(Colour and lustre of *leptocerus* Epp., with similar elytral colour-pattern, but the head is longer, distinctly longer than broad (3 : 2.5), the sculpture finer, and the antennæ distinctly shorter and formed as in *pulchellus* Heer; thorax as in *leptocerus*, but with finer sculpture as on the head; elytra as long as the thorax, not quite so coarsely sculptured as in *leptocerus*, distinctly rugulose, the abdomen distinctly more coarsely punctured than in that species.

♂ : unknown.

Siargao : Dapa.

Astenus thaxteri, sp. n. (Bernh. in litt.).

Moderately shining; head, thorax, and first four visible abdominal tergites dark ferruginous red, the 5th black with the posterior margin reddish yellow, the 6th reddish yellow: elytra blackish, the posterior margin broadly reddish yellow, the base reddish. Antennæ and legs reddish yellow. Length 3.5 mm.

Much resembling *kraatzii* Bernh. in build, but with somewhat broader head, the antennæ similarly constructed. but the colour of the head and thorax is darker and the colour-pattern of the elytra is very like that of *pulchellus* Heer: the sculpture of the fore parts is coarser than in *kraatzii*, that of the abdomen much coarser. Head as long as broad, broader than the thorax; thorax very slightly longer than broad, trapezoidal, the elytra very slightly longer than the thorax.

♂: unknown.

Manila.

Astenus theodorensis, sp. n. (Bernh. in litt.)

Rather dull; head, thorax, and elytra dark reddish brown, the latter with the posterior margin broadly reddish yellow; abdomen pitchy black, the posterior margin of the 7th and greater part of the 8th tergites yellow. Antennæ and legs reddish yellow. Length 3.75 mm.

In size and build of the head, thorax, and antennæ scarcely differing from *nigromaculatus* Motsch., but differently coloured and with shorter elytra with the colour-pattern of *pulchellus* Heer. Head as long as broad, broader than the thorax, the eyes large, the sculpture coarser than in *nigromaculatus*; thorax oviform (2.3:2), the sculpture coarser than on the head; elytra as long as the thorax, more coarsely punctured than in *nigromaculatus*, the puncturation of the abdomen scarcely differing from that species.

♂: 6th sternite with deep broad triangular excision; 5th broadly arcuately emarginate, the emargination furnished with long black closely placed spines.

Mindoro: S. Theodoro.

Astenus staudingeri, sp. n. (Bernh. in litt.).

Black, the posterior margin of the elytra with a short extension along the suture reddish yellow; abdomen with the first four visible tergites dark ferruginous red, the following black, the 6th obscure yellowish brown. Antennæ and legs reddish yellow. Length 3.5 mm.

Near *theodorensis* Cam., but narrower, and with the posterior margin of the elytra more narrowly reddish yellow and the first four visible tergites dark red; head as long as broad, the eyes smaller, the post-ocular region

coarctate with the base, the sculpture much finer, the thorax narrower (2.5 : 1.75), the sculpture as on the head much finer than in that species; elytra as long as the thorax, more finely punctured than in *theodorensis*, abdomen more finely and much more closely punctured as in *pulchellus* Heer. Antennæ as in *theodorensis*, the penultimate segments a little longer than broad.

♂ : unknown.

Mont Alba.

Stilicopsis setigera Shp. s. sp. *macroptera* n.
(Bernh. in litt.).

This differs from the type form in the elytra being slightly longer than the thorax and quite parallel, not at all narrowed at the base

Manila. Bucas. Tenimber; Jandema.

Stilicopsis crenipennis, sp. n. (Bernh. in litt.).

Moderately shining, head and thorax yellowish red, elytra and abdomen reddish yellow. Antennæ and legs reddish yellow. Length 3 mm.

In build much resembling *setigera* Shp., but with more orbicular head and redder colour of the head and thorax. Head as long as broad, a little broader than the thorax, the post-ocular region coarctate with the base, the reticulate-umbilicate sculpture with very large meshes, much larger than in *trinotata* Kr. Antennæ longer than in *setigera*, the penultimate segments fully as long as broad. Thorax trapezoidal, as long as broad, the meshes of the sculpture smaller than on the head, but larger than in *trinotata*. Elytra as long as the thorax, narrower at the base, a little widened behind, coarsely and closely punctured, the side margins with five little teeth (these probably carry setæ as in other species of the genus, but are not present in the single example before me). Abdomen narrowed at the base, much less coarsely and less closely punctured than the elytra.

♂ : unknown.

Luzon : Imugan.

Thincharis longula, sp. n. (Bernh. in litt.).

Moderately shining, black, the posterior margins of the abdominal tergites narrowly rufescent. Antennæ and legs reddish yellow. Length 2 mm.

Near *major* Cam., similar in build and antennal structure, but the thorax much less finely punctured and with distinct median shining line, the elytra differently coloured, much less finely, more closely and roughly punctured. From *carinicollis* Kr. it differs in the colour; the sculpture of the thorax is, however, very similar, but that of the elytra is much coarser, closer, and rougher; from *nigricans* Cam. it differs in the longer antennæ and less fine puncturation of the thorax and elytra.

Luzon : Balbatan.

Thinocharis subdepressa, sp. n. (Bernh. in litt.).

Very near *carinicollis* Kr., of the same colour except that the elytra are blackish posteriorly and also slightly longer, a little longer than broad, whereas in *carinicollis* they are as long as broad; the thorax presents a shining median keel as in that species; the puncturation of the elytra is a little finer and denser, but in all other respects like *carinicollis*.

Luzon : Los Banos.

Pachymedon albomaculatus, sp. n. (Bernh. in litt.
Acanthoglossa).

Shining ferruginous red, the elytra with the outer half of the posterior margin and the postero-external angle yellow, the 5th visible tergite with the posterior margin broadly yellow. Antennæ and legs reddish yellow, the femora infusate. Length 3 mm.

Very like *Acanthoglossa hirta* Kr. in build and antennal structure, but with entirely different sculpture. Head subquadrate, transverse (2.5 : 2), broader than the thorax, the eyes flat, much shorter than the temples, at the middle of the base with a deep sulcus; finely, moderately closely punctured on the anterior half, almost impunctate behind. Antennæ short and stout, scarcely differing from *A. hirta* in construction. Thorax transverse (2.3 : 1.75), convex, trapezoidal, the posterior angles broadly rounded, practically impunctate. Elytra longer (2.3 : 1.75) and broader than the thorax, slightly broader than long, very finely, obsoletely, and not closely punctured. Abdomen a little narrowed at the base and apex, very finely and closely punctured. The whole insect covered with rather close

and long yellow pubescence, at the humeral angles and on the postero-external region of the elytra the pubescence is white.

♂ : unknown.

Luzon : Los Banos.

Pachymedon samarensis, sp. n.

Head and thorax black, scarcely shining, elytra and abdomen more shining, the former dark red more or less infusate behind, the latter pitchy black with the posterior margins of the tergites narrowly rufescent. the 5th (visible) more broadly. Antennæ red. Legs reddish yellow. Length 3.75 mm.

In build and antennal structure very like *Medon bernhaueri* Bernh. and Scheerp., but differently coloured and with less coarse sculpture. Head transversely subquadrate, as broad as the thorax, the eyes rather small, the posterior angles briefly rounded, very closely covered with moderate umbilicate punctures. Antennæ with the penultimate segments slightly transverse. Thorax transverse (3 : 2), convex, the sides gently rounded, retracted behind, the posterior angles rounded, along the middle posteriorly with smooth shining line, the sculpture as on the head. Elytra longer than the thorax (3 : 2), as long as broad, asperately punctured, but more finely and less closely than in *bernhaueri*. Abdomen very finely, moderately closely punctured and pubescent.

♂ : unknown.

Leyte. Samar ; Catbalogan.

Pachymedon sulcithorax, sp. n. (Bernh. in litt. *Medon*).

Shining, pitchy black, the elytra with the posterior margin yellow, narrower at the suture and gradually becoming wider externally ; abdomen reddish brown, the posterior margins of the last two tergites yellow. Antennæ red, the last two or three segments reddish yellow. Legs reddish yellow, the femora infusate. Length 3.5 mm.

In build somewhat like *samarensis* Cam., but more shining, differently coloured and with much coarser sculpture. Head transversely subquadrate, scarcely narrower than the thorax, the eyes moderate. shorter than the temples which are slightly retracted towards the base, the posterior angles rounded ; the disc covered

with rather large and moderately close umbilical punctures which are much closer towards the base. Antennæ moderate, the 3rd to 6th segments a little longer than broad, decreasing in length, 7th as long as broad, 8th to 10th a little transverse. Thorax transverse (2·75 : 2·3), the sides almost straight, moderately retracted towards the base, along the middle with a broad raised impunctate keel, on each side of it in the posterior half with a deep sulcus, the puncturation distinctly closer and rather coarser than on the disc of the head. Elytra longer than the thorax (3 : 2·3), slightly broader than long, closely and much more finely punctured. Abdomen narrowed towards the apex, rather finely and moderately closely punctured on the anterior segments, more finely and less closely posteriorly, the pubescence fine and rather long, but on the fore-parts longer and more sparing.

♂ : unknown.

Dinagat.

Pachymedon micropterus, sp. n. (*Medon microelytra*
Bernh. in litt.).

Dark reddish brown, the head and thorax dull, the elytra and abdomen a little shining. Antennæ red. Legs reddish yellow, the femora a little infusate. Length 4·2 mm

Of the ground-colour of *bernhaueri* Bernh. and Scheerp., but with shorter differently coloured elytra, less transverse more finely punctured head and thorax, the eyes smaller, the punctures on the thorax not at all confluent. Head transverse (3 : 2·5), subquadrate, nearly as broad as the thorax, the eyes small, the temples much longer, parallel, the whole surface closely covered with small umbilicate punctures, the antennæ as in *bernhaueri*. Thorax slightly transverse (3·2 : 2·8), the sides gently rounded and retracted behind, coarctate with the base, the sculpture as on the head. Elytra a little shorter than the thorax (2 : 2·8), slightly narrowed at the base, and a little widened towards the apex, rather finely closely, and roughly punctured. Abdomen narrowed towards the apex, finely and closely punctured and pubescent throughout. Pubescence on the elytra longer and coarser, finer, and much more scanty on the head and thorax.

♂ : unknown.

Luzon : Mt. Isarog.

Medon microcephalus, sp. n. (Bernh. in litt.).

Very near *vermiculatus* Cam., of similar colour, but smaller (5 mm.), the antennæ shorter and stouter, the vermicular sculpture of the thorax finer. Head transverse (2.75 : 2.5), subquadrate, narrower than the thorax, the temples almost straight and very slightly retracted to the rounded posterior angles, as long as the eyes, moderately coarsely, very closely rugosely punctured. Antennæ with the 3rd segment longer than the 2nd 4th to 7th longer than broad, decreasing in length, 8th to 10th about as long as broad. Thorax slightly transverse (3 : 2.75), the sides practically straight and but slightly retracted behind, the posterior angles rounded, along the middle with a fine raised shining line extending from the base almost to the anterior border, the sculpture consisting of granules which on the disc are more or less longitudinally confluent. Elytra longer (3.5 : 2.75) and broader than the thorax, as long as broad, closely, moderately finely granular. Abdomen finely and closely punctured and pubescent, more finely on the last three segments and with some longer black setæ especially at the sides, the sides of the head, thorax, and elytra also with similar setæ.

♂ : 6th sternite with a feeble arcuate emargination.

Leyte.

Medon (Hypomedon) insularis, sp. n.
(Bernh. in litt.).

Shining, entirely reddish yellow. Antennæ and legs reddish yellow. Length 2.75 mm.

Near *immsi* Bernh., but smaller and narrower, the eyes smaller, the thorax with fine granular sculpture. Head transverse, subquadrate, as broad as the thorax, the eyes rather small, the post-ocular region straight, parallel, about half as long again as the eye, the posterior angles rectangular, the puncturation on the disc fine sparing and obsolete, elsewhere less fine and obsolete and much closer. Antennæ as in *immsi*. Thorax transverse (2 : 1.75), trapezoidal, the sides straight and a little retracted backwards, along the middle with narrow shining line, elsewhere rather closely covered with very fine granules. Elytra longer than the thorax (2 : 1.75) slightly broader than long, very finely, moderately closely, asperately

punctured. Abdomen narrowed towards the apex, very finely, moderately closely punctured and pubescent throughout. Pubescence of the fore parts rather sparing and stiff.

♂: unknown.

Luzon; Laguna los Banos.

Medon (Hypomedon) palawanensis, sp. n.

(Bernh. in litt.).

Shining; head, thorax, and abdomen yellowish red, elytra lemon yellow. Antennæ and legs reddish yellow. Length 2.75 mm.

Near *insularis* Cam., but a little narrower, with shorter head, larger eyes, etc. Head transverse (4:3), subquadrate, as broad as the thorax, the eye as long as the temple, the whole surface closely, moderately finely and distinctly punctured, more finely at the base. Antennæ as in *immsi* Bernh. Thorax transverse (2:1.6), trapezoidal, with a very fine short shining line at the middle of the base, elsewhere closely covered with small granules, much larger and closer than in *insularis*. Elytra longer than the thorax (2.5:1.6), as long as broad, closely, finely asperately punctured. Abdomen a little narrowed towards the apex, very finely, rather closely punctured and pubescent. Head and thorax sparingly, elytra more closely pubescent, the head and thorax with a few black setæ at the sides.

♂: 6th sternite broadly, feebly arcuately emarginate.

Palawan: Binaluan.

Charichirus opacicollis, sp. n. (Bernh. in litt.).

Of the build, colour, and lustre of *siebersi* Cam., the structure and colour of the antennæ similar, but the granules of the head are larger and less obsolete, the thorax along the middle has a sharper and much more evident shining line, the sculpture, however, scarcely differs; the sculpture of the elytra is similar to that of *siebersi*, but the reddish yellow colour of the postero-external region is less extensive, being narrower at the suture and not extending so far along the lateral margin; the abdomen as in *siebersi*. Length 5.5 mm.

♂: 6th sternite broadly and scarcely perceptibly emarginate: 5th truncate and furnished with close black spines along a broad area.

Samar: Catbalogan.

Scopæus luzonicus, sp. n.

Shining bright yellowish red, the elytra with oblique brownish fascia from the reflexed margin across the middle to the suture, the scutellary region infusate; abdomen brown. Antennæ and legs reddish yellow. Length 2.75 mm.

Coloration very similar to *nitidulus* Motsch., but with the build and antennal structure of *limbatus* Kr. Head as in *limbatus* very slightly longer than broad and with similar sculpture, thorax in all respects as in that species, but the elytra apart from the different colour-pattern are a little less finely punctured.

♂: unknown.

Luzon: Laguna.

STAPHYLININÆ.

Metoponcus philippinus, sp. n. (Bernh. in litt.).

Shining, black, the posterior fourth of the thorax indeterminately reddish yellow, the base of the elytra narrowly yellow. Antennæ and legs reddish yellow. Length 4 mm.

The smallest species of the genus known to me. Readily recognized by the colour. Head elongate, parallel, as long as and a little broader than the thorax, the lateral sulci long and oblique, extremely finely and very sparingly punctured; ground-sculpture absent. Antennæ short and stout, the 4th to 10th segments strongly transverse. Thorax longer than broad (2.5:1.5), widest in front, the sides straight and gently retracted to the base, practically impunctate. Elytra as long as but slightly broader than the thorax, practically impunctate and without ground-sculpture. Abdomen extremely finely and very sparingly punctured, almost impunctate.

Palawan: Binaluan.

Pachycorynus longiceps, sp. n. (Bernh. in litt.).

Shining, black, the raised lateral and posterior margins of the tergites narrowly and obscurely reddish yellow. Antennæ and legs reddish yellow. Length 4.5 mm.

Colour of *bakeri* Bernh., but smaller and narrower, the punctures of the head smaller, the puncturation of the abdomen finer and less close. Head longer than broad (3:2.5), the sides almost straight and parallel, the

posterior angles rounded, the punctures of the head smaller than in *bakeri*, but otherwise similar as is the ground-sculpture; thorax as in *bakeri*, but the punctures smaller: elytra as long as the thorax, more finely and less closely, more superficially punctured than in that species, the abdomen also is more sparingly punctured.

Luzon: Imugan.

Thyreocephalus rufus, sp. n. (Bernh. in litt.).

Shining, red; the abdomen pitchy red, the elytra with slight purple reflex, the 5th tergite (except the posterior margin) darker. Antennæ with the first three segments red, 4th to 6th grey, the following yellow. Legs reddish yellow. Length 14 mm.

In build ♂ and ♀ scarcely differing from the corresponding sexes of *annulatus* Fauv. Head between the eyes with very small, scattered and obsolete punctures; thorax with similar punctures; elytra as in *annulatus*, but with the punctures not quite so coarse or so close; abdomen punctured as in *annulatus*.

Mindanao: Iligan. Tangolan (Baker).

Thyreocephalus insularis, sp. n. (Bernh. in litt.).

Coloration of *albertisi* Fauv., but the abdomen with strong greenish metallic reflex, the head in the ♀ scarcely differing in shape from that of *albertisi*, but in the ♂ it is smaller, transversely subquadrate, and not at all dilated behind the eyes; the following differences in sculpture in both sexes are present, in *albertisi* the frontal region is very finely and closely longitudinally striate and impunctate, whereas in *insularis* this region is extremely finely and rather sparingly punctured, the minute puncturation of the thorax is very similar in both species, but the oblique striæ at the posterior half of the sides seen in *albertisi* are limited in *insularis* to the neighbourhood of the posterior angles, the puncturation of the elytra is a little coarser in the present species; in other respects similar. Length 12 mm.

Luzon: Mt. Makiling (Baker).

Thyreocephalus fæx, sp. n. (Bernh. in litt.).

Shining; head, thorax, and abdomen with strong metallic green reflex, elytra dark green. Antennæ

reddish brown, the 1st segment black. Legs reddish yellow. Length 10 mm.

In build very like *gestroi* Fauv. Head a little longer than broad, shortly ovate, slightly broader than the thorax, with a curved row of three large punctures on each side of the disc, four others near the base placed transversely and a few smaller ones on the post-ocular region. Antennæ as in *gestroi*. Thorax longer than broad (7 : 5·4), a little narrower than in *gestroi*, practically impunctate: elytra as long as the thorax, coarsely, closely rugosely punctured on the disc, the reflexed sides much more finely and with long yellow pubescence: abdomen very finely and very sparingly punctured.

Luzon : Imugan.

Philonthus philippinus, sp. n. (Bernh. in litt.).

Shining, black: thorax with dorsal row of five punctures. Antennæ black, the 1st segment pitchy. Legs pitchy black, tarsi reddish yellow. Length 7·5 mm.

Size and build of *maindroni* Fauv., but entirely black, the thorax with dorsal row of five punctures, the antennæ a little shorter.

♂: Head subquadrate, slightly broader than long, as broad as the thorax, the eyes large, the post-ocular region slightly retracted, the posterior angles rounded, median inter-ocular punctures widely separated from each other, the front with superficial impression, at the inner border of the eye with several small punctures and a few others between its posterior border and the neck, ground-sculpture fine, transverse and wavy, in the ♀ the head is smaller, as long as broad. Antennæ with the penultimate segments as long as broad. Thorax longer than broad (4·3 : 3·75), the sides straight and parallel, the 5th puncture of the dorsal row remote from the 4th. Elytra longer than the thorax (5 : 4·3), more closely and less finely punctured than in *maindroni*. Abdomen more closely and less finely punctured at the bases of the segments. First segment of the posterior tarsi as long as the last.

♂: Anterior tarsi dilated: 6th sternite with acute triangular smooth impression, its base deeply arcuately emarginate.

Luzon : Balbalan.

(To be continued.)

XXIX.—*Some undescribed Species of Melolonthid Coleoptera from Western New Guinea and the Adjacent Islands of Waigeu and Japen.* By GILBERT J. ARROW, British Museum (Natural History).

THE insects here described were taken by Miss L. E. Cheesman during her collecting expeditions in 1933–4 and 1938–9, with the exception of a few which have been added for greater completeness. Owing to the dispersal of the British Museum collections rendered necessary by the destructive fury of Germany, it has not been possible to deal with the family Melolonthidæ as a whole, and three genera only are included here, one of them previously unknown. Of the eighteen new species, eight were found by Miss Cheesman in the little-explored islands of Waigeu and Japen, the latter hitherto incorrectly known as Jobi Island. One species, *Mæchidius jobiensis* Moser, from that island, described in 1920, is not known to me.

The predominant genera of Melolonthidæ of the Papuan Region appear to be *Lepidiota*, *Lepidoderma*, *Apogonia*, *Heteronyx*, *Mæchidius* and the new genus *Menigionyx*. Of these, *Lepidoderma* and *Mæchidius* are Australian and Papuan only, *Heteronyx* is probably the most abundant genus of beetles in Australia, *Lepidiota* is largely represented there, *Apogonia* is widely distributed in the Old World but unknown in Australia, and *Menigionyx* appears to be confined to the Papuan Region.

Note.—The name *Lepidoderma*, having been preoccupied in 1855, must be replaced and I propose to substitute the name *Dermolepida*.

Genus *MÆCHIDIUS*.

This genus has long been known as a conspicuous element in the Australian fauna, abundant both in species and individuals. It may perhaps be found to abound to an equal extent in the Papuan Region. About twenty Papuan species have at present been described by two German entomologists, Heller and Moser, and several species were found in large numbers by Miss Cheesman. In spite of their abundance, little seems to be known of

XXX.—*The British Species of Scruparia (Polyzoa)*. By ANNA B. HASTINGS, M.A., Ph.D., British Museum (Natural History).

THE genotype of *Scruparia* Oken (1815) was established by Harmer (1923, p. 316). Hitherto there has been supposed to be one British species, *S. chelata* (Linn.), with some not very clearly defined varieties. While considering some specimens of the genus, brought from the Patagonian region by the 'Discovery' Expedition, I re-examined the supposed material of *S. chelata* in the British Museum and found that it comprised two well-marked species, both widely distributed, and both found in Britain.

Typical *S. chelata* has relatively large horn-shaped zoecia, and the erect branches arise from creeping stolons (fig. 1, A). The ovicells are large and are nearly as long as the fertile zoecia, whose opesia is broader than long (fig. 2, C). The other species, which I recognize as *S. ambigua* (d'Orb.), see below, is more delicate, and has zoecia arising from encrusting zoecia instead of from stolons (fig. 1, B). The opesia of the non-fertile zoecia is longer and is parallel to the basal wall of the zoecium, instead of dipping obliquely towards the distal end. The ovicell is not only absolutely smaller than that of typical *S. chelata*, but also smaller relatively to the fertile zoecium (fig. 2, A, B). The opesia of the fertile zoecium is longer than wide. The encrusting zoecia of *S. ambigua* may give rise to buds distally, frontally and on each side. All the buds form zoecia, the frontal one being erect and the others encrusting. The encrusting stolons of *S. chelata* form more or less distinct swellings at intervals which have already been recognized as probably the morphological equivalent of zoecia (Hincks, 1880, p. 13). Each swelling may give rise to buds distally, frontally and on each side. The frontal one forms erect zoecia, the lateral ones encrusting rootlets, an arrangement exactly comparable to that just described in *S. ambigua*.

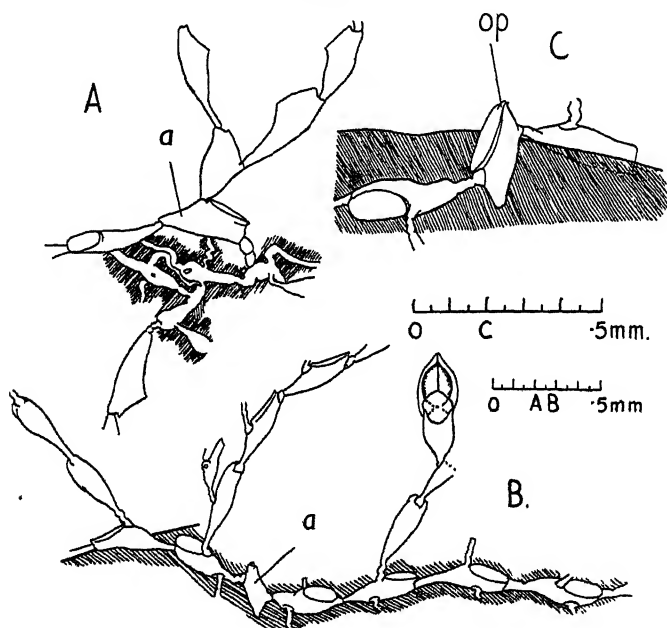
The two species are mixed on the same weed, hydroids etc., in the Museum's British material, but are clearly recognizable, even without ovicells, when once the

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difference in the shape and size of the zoëcia and the nature of the encrusting part has been noticed.

Hincks's figure (1880, pl. ii. fig. 4) of horn-shaped zoëcia springing from an apparently encrusting series of similar

Fig. 1.



A. *Scruparia chelata* (Linn.). South Devon. Hincks Coll. 99.5.1.317 B.
Showing ancestrula, creeping stolons, and erect branches.

B, C. *Scruparia ambigua* (d'Orb.). Tagus Cove, Galapagos. 29.4.26.15.
B. Showing ancestrula, creeping and erect zoëcia, and a fertile zoëcium.

C. Ancestrula and first two zoëcia on weed.

The substratum around the encrusting parts is indicated by hatching.

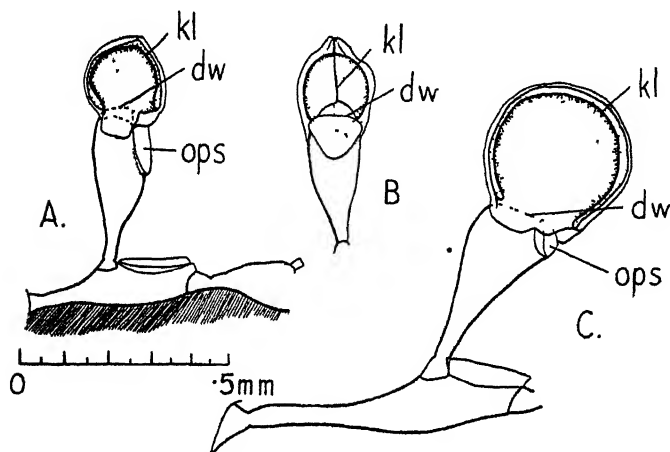
a., ancestrula ; op., operculum.

zoëcia appears to invalidate the distinction recognized here, but is, I think, erroneous. On drying, the erect branches of *S. chelata* commonly come to lie in just this way, as could be seen in Hincks's own specimens, but

I have seen no specimen where any zoecia of this type are truly encrusting.

Gosse (1853), who gives a vivid account of his observations on *S. chelata* (pp. 132-139), shows the characteristic stolon in one of his figures (pl. vi. fig. 2), and it is also

Fig. 2.



A, B. *Scruparia ambigua* (d'Orb.). Tagus Cove, Galapagos. 29.4.26.15.

Fertile zoecia in lateral and frontal view. In A the encrusting zoecia from which the fertile zoecium arises are shown. Substratum hatched.

C. *Scruparia chelata* (Linn.). Roscoff. 22.8.1.3.

Fertile zoecium on an erect zoecium drawn in the same position as A for comparison.

dw., distal wall of zoecium ; *kl.*, keel ; *ops.*, opesia.

shown in the original figure of the species (Ellis, 1755, pl. xxii. fig. B).

I have no doubt that the more delicate species is the form for which Hincks (1880) proposed the name *Eucratea chelata* var. *gracilis*, but there is no British specimen of the more delicate species in the Hincks Collection *, nor any specimen labelled as belonging to the variety. Hincks's Australian material of supposed *E. chelata* is represented by two slides each with very few zoecia.

* At the time when this revision of the British material was done, one slide of *S. chelata* from the Hincks Collection (99.7.1.588) was stored for the war and could not be examined.

one labelled "normal form," the other "slender form," but both belong to the more delicate species. I have seen no specimen of typical *S. chelata* from Australia, but there is material of both species from New Zealand.

It is probable, however, that *S. chelata* var. *gracilis* as here understood, is a synonym of *S. ambigua* (d'Orb., 1841). D'Orbigny's species came from the Falkland Islands (Îles Malouines), which is one of the localities of var. *gracilis*, D'Orbigny's figures agree with var. *gracilis* in the shape and general proportions of both fertile and non-fertile zoöcia. They show neither the keel nor the aperture of the ovicell, nor the opesia of the fertile zoöcium, but the absence of any opening is evidence that the fertile zoöcia are not drawn accurately. The dimensions of d'Orbigny's specimens are not known, and there is no indication of the nature of the encrusting part, but, in view of the agreement in locality and general shape and proportion, the identification seems very probable.

The specimens from the Galapagos Islands recorded as *S. chelata* (Hastings, 1930) have ovicells and belong to *S. ambigua* as understood here. Similar colonies, without ovicells, have been obtained from Norway, California, Australia, Tasmania, New Zealand, the Falkland Islands, and the coast of Patagonia. The erect zoöcia of the Californian form figured by Robertson (1905, pl. v. fig. 8) agree closely with *S. ambigua*, and the encrusting zoöcia are described. Ovicells were not found; pl. v. fig. 9, showing an ovicell, is "after Hincks," and represents true *S. chelata*.

Hasenbank (1932, p. 325, text-fig. 1) gave characteristic figures of the non-fertile zoöcia of *S. ambigua* (as *Eucreatea chelata*) from Amsterdam Is. He mentioned several of the important differences, notably the encrusting zoöcia and the fact that the erect zoöcia are not horn-shaped, and compared it to the varieties *gracilis* and *repens* of Hincks.

Smitt's figures (1867, pl. xvi. figs. 7-9) resemble *S. ambigua* rather than *S. chelata*, and his statement (p. 301) that buds may be formed at the right and left of the zoöcia, as well as distally and frontally, but that these lateral buds are only found on the creeping part of the stock, implies that the creeping part was composed of zoöcia. In some of the figured zoöcia the opesia is rather short, although parallel to the basal wall.

The encrusting form described by Hincks as var. *repens* closely resembles the encrusting base of a colony of *S. ambigua*. The frequent presence of the little stalk-like projections proximal to the orifice suggests that erect zoecia may once have been present, and one such zoecium remains in a specimen from the Adriatic identified by Hincks with var. *repens*. This erect zoecium has the form of those of *S. ambigua*. The variety is certainly allied to *S. ambigua* rather than to *S. chelata*, and I doubt very much whether it should be maintained.

The fertile zoecia of *S. ambigua* may arise directly from the encrusting zoecia as in fig. 2, A, or from erect branches, as in fig. 1, B. The ovicells of both *S. chelata* and *S. ambigua* have a membranous ectoecium, a calcareous entoecium and a conspicuous median keel, seen as a projecting flange in side view (lightly stippled in fig. 2, A, C). A side view also shows the origin of the ovicell from a quadrilateral area on the shoulder of the fertile zoecium. The appearance of the ovicell suggests that it may be of the two-valved type (see Harmer, 1926, p. 189). In this connection it is interesting to find that the ovicells of *S. chelata*, like the two-valved ones of *Thalamoporella*, may contain several embryos. As many as seven have been counted in a single ovicell in material from Roscoff (B.M. 22.8.1.3). Only empty ovicells are to be found in the material of *S. ambigua*.

The material from Roscoff (fig. 2, C) has zoecia with the tubular part long and the opesia rather short, and represents the form described as var. *elongata* by Lomas (1886, p. 165). Such colonies have a distinctly different appearance, but the variation among the individual zoecia of both the typical form and the variety makes me doubt whether they should be distinguished. Lomas figures an almost circular opesia, but the outline of the zoecia of his specimen, which has become decalcified while fixed in a mount of glycerine jelly, suggests that the drawing is inaccurate, and that var. *elongata* really has an oval opesia like that of the other elongate specimens in the British Museum.

Ancestrulae are present in material of *S. ambigua* from Britain, the Patagonian coast and the Galapagos Islands, and are very numerous in the latter. Even at this early stage the two species are clearly distinguishable. In both the ancestrula is attached only by the structures

budded from it. In the ancestrula of *S. chelata* (fig. 1, A) the distal bud forms a rootlet which promptly attaches itself to the substratum and forms the creeping base of the colony. The ancestrula also produces a frontal and a proximal bud, each of which gives rise to an erect series of zoecia. The proximal bud faces in the opposite direction from the ancestrula, and this appearance of reversal clearly distinguishes an ancestrula from a zoecium which has formed a distal rootlet, as they occasionally do.

In *S. ambigua* (figs. 1, B, C) the distal bud likewise forms the creeping base of the colony, but it takes the form of a zoecium and gives rise to a series of zoecia. There is no proximal bud, and the frontal bud, like the distal bud, forms an encrusting zoecium leading to a series of encrusting zoecia from which erect branches arise. The ancestrula of *S. ambigua* lies on its side, that of *S. chelata* may be described as standing on its head.

The figured ancestrula of *S. chelata* (fig. 1, A) is one of several in Hincks's material from S. Devon. They were, however, mounted in a confused state on crumpled seaweed, and it was not until they had been cleaned and disentangled that their characteristic structure could be made out. This may account for the puzzling appearance of Hincks's figures which are, perhaps, not quite accurate. It seems likely that, in pl. ii., figs. 6, 7 and 8 represent *S. ambigua*, and fig. 5 *S. chelata*. The erect zoecia in fig. 5 are certainly those of *S. chelata*, but, as in *S. ambigua*, the first zoecium is encrusting and the ancestrula has no proximal bud.

It is likely that some of the other published records of *S. chelata* are based on *S. ambigua*, and it is thus not possible to give a full statement of the synonymy and distribution of either species. I am therefore giving statements of the synonymy and distribution of *S. ambigua*, as far as I have been able to establish them, and a list of the specimens of true *S. chelata* in the British Museum.

Synonymy of Scruparia ambigua (d'Orb.).

Euoratea ambigua d'Orbigny, 1841, pl. iii. figs. 13-17; 1847, p. 11.

Catenaria ambigua d'Orbigny, 1851, p. 43.

Euoratea chelata Robertson, 1905, p. 248, pl. v. figs. 7, 8; Vallentin, 1924, p. 373; Hasenbank, 1932, p. 325, text-fig. 1 (not *Sertularia chelata* Linn.).

Scruparia chelata Hastings, 1930, p. 702.

Eucratea chelata var. β *gracilis* Hincks, 1880, p. 14; Lomas, 1886, p. 165.

? *Eucratea chelata* var. *a repens* Hincks, 1880, p. 14, pl. i. fig. 3.

? *Eucratea chelata* Smitt, 1867, pp. 281, 301, pl. xvi. figs. 7-9.

Distribution of Scruparia ambigua (d'Orb.).

Specimens with ovicells.—Devonshire (11.10.1.256, Norman Coll., with *S. chelata*); Bantry Bay, Ireland (1940.11.6.1, with *S. chelata*); Gouliot Caves, Sark (1940.11.4.1, Norman Coll., with *S. chelata*, 12.12.21.800); Galapagos Islands (Hastings; 29.4.26.15, 16); Falkland Islands (d'Orbigny).

Specimens without ovicells.—Britain (99.7.1.590, Busk Coll.; 15.4.2.8, Norman Coll., both with *S. chelata*); Aberdaron Bay, N. Wales (1940.11.10.1, collected by Dr. F. C. Fraser and Mr. D. D. John, with *S. chelata*); Florø, Norway (12.12.21.803, Norman Coll.); Sweden? (Smitt); California (Robertson; 1938.11.30.6, from Dr. A. Blagg); Falkland Islands (35.3.6.29, Vallentin Coll.); coast of Patagonia ('Discovery' Investigations, Stations 1902, W.S. 95, W.S. 847); Cape Horn ('Discovery' Investigations, Station 222); Amsterdam Is., Indian Ocean (Hasenbank); Australia (99.5.1.320, 321); Port Phillip Heads (97.5.1.147-149, 152; 88.11.14.443); Queenscliffe Jetty, Port Phillip ('Discovery' Investigations, Station 1686); Adelaide (99.7.1.591, Busk Coll.); Tasmania (99.7.1.592, Busk Coll.); New Zealand (27.8.4.1, with *S. chelata*; Terra Nova Exp. Station 134).

As var. repens.—On shell, locality unspecified, presumably Isle of Man (99.5.1.417, Hincks Coll.); Adriatic (99.51.416, Hincks Coll.).

Specimens of Scruparia chelata (Linn.) in the British Museum.

Specimens with ovicells.—Penzance (99.7.1.587, 589, Busk Coll.).

Specimens without ovicells.—Britain (99.7.1.590, Busk Coll., with *S. ambigua*; 99.7.1.5753, Busk Coll.); Hastings (1940.11.8.1, Bowerbank Coll.); Weymouth (99.7.1.586, Busk Coll.); S. Devon (99.5.1.317, Hincks Coll.); Devon (11.10.1.256, Norman Coll., with *S. ambigua*); Tenby (97.5.1.150); Aberdaron Bay, N. Wales (1940.11.10.1, collected by Dr. F. C. Fraser and Mr. D. D. John, with *S. ambigua*); Liverpool (27.6.29.3); Birrterbuy Bay,

Ireland (12.12.21.802, Norman Coll.); Bantry Bay, Ireland (1940.11.6.1, with *S. ambigua*; 1940.11.6.2); Whitby (99.7.1.585, Busk Coll.); Filey (34.10.24.9); New Zealand (27.8.4.11, with *S. ambigua*); locality unknown (11.10.1.255, Norman Coll., from Mr. Barlee).

Elongata-type.

Specimens with ovicells.—Roscoff (22.1.8.3, three slides mounted by Sir Sidney Harmer).

Specimens without ovicells.—Isle of Man (86.1.9.7, Lomas Coll.); Raasay, Inverness-shire (1938.10.28.2, King's College Newcastle Expedition); Gouliot Caves, Sark (12.12.21.800, Norman Coll., with *S. ambigua*, 1940.11.4.1).

The specimen from the Tizard Bank, recorded by Kirkpatrick (1890, p. 16) as *E. chelata*, consists of very few zoecia, but appears to be related to *Brettia tropica* Waters (1913, p. 465) rather than to *S. chelata*.

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their habits Miss Cheesman took them chiefly at light, and, since many specimens have mud adhering to them, it may be assumed that they hide beneath the soil by day and emerge at night.

The sexual differences have not been noted by either of the two authors mentioned, although they are sometimes considerable. They are found chiefly in the greater development of the clypeal lobes of the male, more slender front tibiae, with feebler teeth, and longer tarsi, especially in the hind legs. It is possible that male and female of the same species have been described under different names, but this may not be discoverable without comparison of the types in the Museums of Berlin and Dresden. A few more species are described here.

Mæchidius nanus, sp. n.

Piceo-niger, nitidus, fere nudus, pedibus antennisque rufis; modice elongatus, parum convexus, capite pronotoque regulariter sat crebre haud dense punctatis, punctis annulatis, haud grossis, clypeo nitidissimo, margine antico reflexo, (♂) sat profunde exciso, angulis fere acutis, (♀) leviter exciso, angulis obtusis, capitis lateribus fere rectis; pronoto lato, parum convexo, lateribus regulariter arcuatis, angulis anticis sat acutis, posticis obtusis vel nullis; elytris parum crebre aut grosse seriato-punctatis, punctis annulatis, plus minusve biseriatim ordinatis, intervallis nitidis, sat vage costatis; pygidio modice crebre annulato-punctato; tibiis anticis extus tridentatis, tarsorum posticorum articulo primo quam secundo vix longiori; ♂, pedibus distincte longioribus.

Long. 3.5-4 mm.; lat. max. 2.2-5 mm.

WAIGEU: Camp Nok, 2500 ft. (Miss L. E. Cheesman, April).

Large numbers of this, the smallest known Papuan species of the genus, were attracted to light. It is almost, but not quite, black above, with the clypeus, legs and lower surface reddish. The puncturation of the upper surface is strong but not very close, the surface is shining and almost naked, although extremely minute setæ can be detected in the punctures under a high power of the microscope. The sides of the head converge strongly and are not lobed, the front margin is very feebly excised in the female, more strongly in the male, in which the angles

are rather sharp. The front tibiæ are sharply tridentate. The tarsi of the male are moderately long.

Mæchidius sturnus, sp. n.

Niger, opacus, corpore supra dense rugoso, subtus crebre punctato, scutello griseo, elytris maculis griseis irregularibus sparsutis, singula seta erecta arcuata instructa; oblongus, pedibus sat longis, tibiæ anticæ apice acute producto, tarsorum posticorum articulo basali quam secundum longiori; clypeo nitido, punctato, antice emarginato, angulis fere acutis, haud productis; pronoto medio fortiter tumido, canaliculato, marginibus lateralibus arcuatis, postice leviter contractis, angulis posticis obtusis, anticis vix acutis; elytris dense vermiculatis, humeris partibusque ante-apicalibus tumidis.

Long. 8 mm.; lat. max. 5 mm.

JAPEN I. (*Miss L. E. Cheesman*).

The single specimen appears to be a male. This is the second species of the genus discovered in Japen Island. It has evidently no resemblance to *M. jobiensis* Moser, and is quite unlike any other species known to me. The irregularity of its upper surface, the absence of any linear arrangement in the sculpture of the elytra and the scattered grey spots with which these are decorated render it easily recognizable. The whole surface bears very minute short yellow setæ, and there are, in addition, chiefly upon the posterior part of the elytra, moderately large isolated setæ, erect and curved, each of which occupies the centre of a horseshoe-shaped elevation. These elevations present the appearance of small grey spots, owing to a thick covering of minute white hairs or setæ. They are quite irregularly distributed. The whole upper surface is very uneven, only the head and the depressed parts of the pronotum are distinctly punctured, and the rest is densely covered with wavy ridges. The posterior part of the head, the median part of the pronotum (which is deeply grooved in the middle), and the shoulders and posterior lateral part of the elytra are strongly tumid. The clypeus is moderately broad, shining, curvilinearly excised in front, with the angles rather sharp but not produced. The lateral margins of the thorax are evenly rounded, minutely serrate, the angles not sharp. The scutellum is thickly clothed with

minute grey hairs. The pygidium and lower surface are closely and deeply punctured, the punctures bearing pale setæ. The legs are fairly slender, the front tibia bearing a curved and acute terminal tooth only, and the tarsi clothed with soft pale hair. The outer spur of the middle tibia is hooked.

Mæchidius pedarioides, sp. n.

Niger vel piceo-niger, subnitidus, pronoto opaco, dense punctato, elongatus, parum convexus, capite crebre punctato et setoso, clypeo nitido, lateribus bisinuatis, margine antico (♂) fortiter exciso, angulis acutis, (♀) leviter exciso, angulis obtusis; pronoto crebre reticulato-punctato, punctis lateralibus majoribus, lateribus æqualiter arcuatis, breviter setosis, angulis anticis sat acutis, posticis obtusissimis. scutello modice punctato; elytris crebre biseriatis umbilicato-punctatis, lineis lævibus vix elevatis interpositis, pygidio opaco, fortiter annulato-punctato, punctis setiferis; corpore subtus fortiter punctato, nitido; tibiis anticis 3-dentatis, tarsorum posticorum articulo primo quam secundo multo longiori.

Long. 6.5–7 mm.; lat. max. 3.5 mm.

WAIGÉU: Camp Nok, 2500 ft. (Miss L. E. Cheesman, April to June).

Nearly related to *M. humeralis* and *interruptocarinulatus* Hell., but with the elytra punctured in double series and moderately shining, the sides of the head not lobed and the hind angles of the pronotum extremely blunt. The puncturation of the upper surface is close, but less so than in *M. interruptocarinulatus*, which is also broader and more convex. The legs are much less stout, the front tibia tridentate. The male has the clypeus narrowed and sharply bidentate in front, the front tibia narrow, with the uppermost tooth feeble and obtuse, and the hind tarsus rather long.

Mæchidius muticus, sp. n.

Ater, ubique minute fulvo-setulosus, compactus, parallelus, modice elongatus, capite pronotoque dense et fortiter punctatis, punctis minute setulosus, illius lateribus vix sinuatis, clypeo antice nitido, reflexo, fere recto, angulis (♂) acutis, (♀) obtusis; pronoto reticulato-punctato, lateribus antice arcuatis, postice fere rectis, angulis omnibus acutis; elytris fortiter et dense seriato-punctatis, costis duabus

dorsalibus angustis, fere integris, nitidis, antennis pedibusque griseis, tibia antica sat lata, extus haud distincte dentata, tarsorum posticorum articulo primo quam secundo paulo longiori.

Long. 7-8 mm. ; lat. max. 3.5 mm.

DUTCH NEW GUINEA : Bewani Mts., 1300 ft., Humboldt Bay District (*W. Stüber*, July).

The front tibiae of this species are very blunt at the end and without distinct lateral teeth, and those of the female are very broad. It resembles *M. paupianus* Heller, but is everywhere very strongly, evenly and closely punctured, each puncture enclosing a very minute yellow seta. The clypeus is only feebly emarginated in front, and the lateral margins are not distinctly lobed, but the angles are sharp in the male. The hind, as well as the front, angles of the pronotum are acute.

Mæchidius angusticeps, sp. n.

Niger, antennis pedibusque griseis : compactus, parum clongatus, capite fortiter punctato, clypeo nitido, antice angustato, acute bidentato ; pronoto convexo, dense reticulato-punctato, lateribus antice arcuatis, postice leviter excisis, angulis omnibus acutis ; elytris dense et fortiter seriato-punctatis, costa suturali duabusque dorsalibus angustissimis nitidis, punctis omnibus setas minutissimas ferentibus ; tibia antica apice minute bidentata, tarsorum posticorum articulo primo quam secundum paulo longiori.

Long. 6 mm. ; lat. max. 3 mm.

DUTCH NEW GUINEA : Bewani Mts., Humboldt Bay Distr., 1300 ft. (*W. Stüber*, July).

I have seen only a single male specimen. It closely resembles *M. muticus*. The upper surface is practically identical in sculpture, but the setae contained in the punctures are still more minute and almost invisible. It is a rather shorter insect and the clypeus is produced, narrowed and strongly bidentate in front. The pronotum is convex, its lateral margin distinctly but not strongly excised before the hind angle, which is acute. The front tibia bears two acute but very small teeth close together at its extremity. The species appears, according to the description, to resemble *M. parallelcollis* Moser, but is smaller, the pronotum is entirely, not partially, reticulate-punctate, and the pygidium is not pilose but bears minute

inconspicuous setæ only a little longer than those upon the upper surface.

Mæchidius hirtipes, sp. n.

(*brisco-niger*, opacus, minute flavo-setosus, clypeo nitido, metallico, pedibusque nitidis, pieco-rufis; capite antice late exciso, angulis productis, haud acutis, lateribus bilobatis, grosse et crebre punctato; pronoto brevi haud lato, densissime grosse punctato, lateribus fere rugosis, marginibus lateralibus crenatis, antice rectis, postice bisinuatis, angulis omnibus acute productis, scutello opaco: elytris quam pronotum multo latioribus, indistincte tricostatis, costis ex granulis irregularibus compositis, erecte setosis, intervallis latis, minute disperse granulatis et setosis; metasterno grosse annulato-punctato, abdomine punctis breviter setiferis instructo; pedibus sat gracilibus, tibiis anticis tridentatis, tarsorum posticorum articulo primo quam secundum duplo longiori:

♂, clypei angulis anticis paulo productis, tarsorum posticorum articulis duobus basalibus intus flavo-ciliatis.

Long. 8.5-10 mm.; lat. max. 4.5-5.5 mm.

N.E. NEW GUINEA: Saiko, 5500-6000 ft., Bubu River (Upper Waria) (*F. Shaw Mayer*, Sept. to Oct.).

This and the following species resemble *M. subcostatus* Hell. in size, form and sculpture, but are narrower, the constriction of the posterior part of the thorax is not so abrupt and affects more than one-sixth of the lateral margin, and the hind angles are very acute. The males have tridentate front tibiæ, and their hind tarsi show well-marked peculiarities. In *M. hirtipes* the basal joint is twice as long as the second and both are closely fringed with pale hairs at the inner edge, the fringe of the basal joint long. The clypeus is shining and more or less metallic, but rather less smooth than that of *M. tarsalis*, and its front angles are more produced in the male. The remainder of the head is very closely and coarsely punctured, each puncture with a central granule, and the sides are bilobed. The pronotum is similarly but still more densely punctured except in its lateral part, where it is subrugose. The front angles are sharply produced, the sides crenulate, straight to the middle and then bisinuate, with the hind angles acute. The elytra are together much broader than the thorax, and have slight indications of a sutural and three discoidal costæ, bearing

short erect setæ, the broad flat intervals bearing minute scattered granules and very minute setæ. The lower surface is shining, the metasternum with large annular punctures and the abdomen with smaller punctures, each of which bears a very short seta.

Two male specimens were found.

Mæchidius tarsalis, sp. n.

Nigro-piceus, opacus, minute flavo-setosus, clypeo nitido, metallico, antennis pedibusque rufis; capite antice late exciso, angulis anticis paulo productis haud acutis, lateribus bilobatis, capite et pronoto grosse densissime punctatis, minute setosis, hoc brevi haud lato, angulis anticis paulo productis, lateribus crenatis, leviter arcuatis, postice excisis, angulis posticis acutis, scutello opaco; elytris opacis, quam pronotum multo latioribus, costis interruptis tribus parum distinctis discoidalibus, parce setosis, intervallis planis brevissime setosis; corpore subtus crebre punctato et setoso, pedibus sat gracilibus, tibiis anticis tridentatis, tarsorum posteriorum articulo basali quam secundum paulo longiori:

♂, tibiæ anticæ dente tertio minuto, tarsorum posteriorum articulo basali subtus excavato, antice angusto, postice dilatato, marginibus longe ciliatis.

Long. 8-9 mm.; lat. max. 4.5 mm.

N.E. NEW GUINEA: Kokoda, 1200 ft. (*Miss L. E. Cheesman*, Aug.).

M. tarsalis closely resembles *M. hirtipes* and has the same narrow shape, but the upper and lower surfaces are more opaque, the punctures of the former rather and those of the latter much less coarse, the sides of the pronotum are less straight and the posterior excision begins farther back. The lower surface is very closely punctured and clothed with yellow setæ, which are much longer and more numerous than those of *M. hirtipes*. In the male the front angles of the clypeus are a little more produced than in the female but less than in the same sex of *M. hirtipes*, the front tibiæ are more feebly tridentate, and the basal joint of the hind tarsus is rather short, hollowed beneath, narrow at the base and broadly dilated behind, with its lateral margins stiffly fringed.

Mæchidius opatroides, sp. n.

Niger vel piceo-niger, toto griseo-indutus, corpore supra setis erectis clavatis haud dense vestito; elongatus, paulo

deplanatus, pedibus modice gracilibus, capitis lateribus fere rectis, convergentibus, margine antico leviter exciso, angulis acutis, vertice gibboso, medio leviter impresso; pronoto lato, medio fortiter convexo, postice paulo contracto, angulis omnibus productis, haud acutis, lateribus sat late elevatis, bisinuatis, marginibus anticis et posticis rotundatis; elytris seriatim punctatis et setosis, setarum serie juxta-suturali duabusque geminatis dorsalibus longioribus, clavatis, utroque elytro puncto subapicali nigro nitido minuto ornato; tibia antica apice minute bidentata, tarsorum posticorum articulo basali quam secundum duplo longiori. Long. 9 mm.; lat. max. 4 mm.

WARGEU I.: Camp Nok, 2500 ft. (*Miss L. E. Cheesman*, April).

This forms a link between the very peculiar *M. pauxillus* Hell. and more typical species of the genus. Like *pauxillus* it has a transverse crest between the eyes, but it is of very different shape. It rather closely resembles the members of the Tenebrionid genus *Opatrum* both in shape and in the grey matter which covers the whole body except the clypeus, the inner surface of the legs and a very small spot near the extremity of each elytron. These are shining black. It is larger, more elongate and less convex than *M. pauxillus* and the pronotum is broad, elevated in the middle, with sharply raised lateral margins. The sides are rounded in front and excised before the hind angles. The surface is deeply punctured and minutely setose, except upon the raised margins, and there are stouter setæ upon the anterior median part and the lateral edges. The elytra are similarly punctured and bear numerous longer clubbed scales or setæ in longitudinal rows.

Four specimens were taken.

The seven species described above are all furnished with membranous lobes beneath the claws. They may be tabulated as follows:—

- | | | |
|---------|---|-------------------------|
| 1 (14). | Head without a transverse crest between the eyes. | |
| 2 (11). | Pronotum not strongly contracted behind. | |
| 3 (4). | Shining above, very small | <i>nanus</i> , sp. n. |
| 4 (3). | Densely sculptured and dull above, size moderate. | |
| 5 (6). | Elytra closely vermiculate | <i>sturnus</i> , sp. n. |
| 6 (5). | Elytra costate. | |
| 7 (8). | Front tibiæ not toothed | <i>muticus</i> , sp. n. |
| 8 (7). | Front tibiæ toothed. | |

- | | | |
|----------|--|-----------------------------|
| 9 (10). | Front tibiæ bidentate | <i>angusticeps</i> , sp. n. |
| 10 (9). | Front tibiæ tridentate | <i>pedarioides</i> , sp. n. |
| 11 (2). | Pronotum very strongly contracted behind. | |
| 12 (13). | Basal joint of the hind tarsus long..... | <i>hirtipes</i> , sp. n. |
| 13 (12). | Basal joint of the hind tarsus not long .. | <i>tarsalis</i> , sp. n. |
| 14 (1). | Head with a transverse crest between the eyes..... | <i>opatroides</i> , sp. n. |

MENIGIONYX, gen. nov.

Corpus breve, convexum, nudum. Pedes breves, tibiæ anticæ bidentatæ, posteriores 4 apice haud dilatatæ, spinosæ, tarsi filiformes, unguiculi robusti, basi appendiculati. Coxæ intermediæ valde obliquæ. Metasternum postice anguste lobatum, lateraliter obliquum. Antennæ 8-articulatæ, clava femina triphylla, maris tri- vel quadriphylla. Labrum latum, prominens, fortiter bilobatum. Mandibula brevissima. Maxilla intus fortiter pluridentata. Mentum subtus gibbosum vel conicum.

Genotype : *M. læviscutum*, sp. n.

This is an aberrant member of the group *Heteronycides* of Lacordaire. It is distinguished by its short, compact, usually more or less ovate shape, the absence of hairy clothing, the appendiculate claws and the very thick, sometimes conical, mentum. The metasternum is strongly lobed between the hind coxæ, and both these and the middle coxæ are oblique. The antennæ consist of eight joints the interval between the scape and club is very short and it is noteworthy that, as in some other Melolonthid genera (e. g. *Megistophylla*), the number of joints in the club of the male is variable. It may consist of three or four. In the female there are three only.

The known species are all Papuan and it seems probable that the genus will be found to be characteristic of the western part of New Guinea and adjacent islands. The only species at present known to inhabit the eastern part is by no means a typical one.

The following table should facilitate recognition of the known forms.

- | | | |
|---------|---|-----------------------------|
| 1 (12). | Pronotum densely punctured. | |
| 2 (9). | Oblong-oval ; elytra not strongly carinate. | |
| 3 (8). | Hind angles of the thorax obtuse. | |
| 4 (5). | Scutellum smooth, unpunctured | <i>læviscutum</i> , sp. n. |
| 5 (4). | Scutellum smooth, punctured. | |
| 6 (7). | Front margin of clypeus not angulate ... | <i>flabellatus</i> , sp. n. |
| 7 (6). | Front margin of clypeus angular | <i>nasutus</i> , sp. n. |
| 8 (3). | Hind angles of the thorax not obtuse | <i>rectangulus</i> , sp. n. |
| 9 (2). | Oval ; elytra strongly carinate. | |

- 10 (11). Elytral costæ sharply elevated *lyrrhoides*, sp. n.
 11 (10). Elytral costæ less sharply elevated *ovalis*, sp. n.
 12 (1). Pronotum not densely punctured.
 13 (14). Black above; pronotum and elytra
 carinate *carinatus*, sp. n.
 14 (13). Pale above; pronotum and elytra not
 carinate *pallidus*, sp. n.

Menigionyx læviscutum, sp. n.

Niger, antennis pedibusque flavis, oblongo-ovalis, convexus, capite et pronoto fortiter æqualiter et dense punctatis, clypei margine antico fere recto, medio vix elevato; pronoti medio plerumque linea lævi angusta longitudinali notato, lateribus pone medium obtuse angulatis, angulis anticis acutis, posticis obtusis; scutello nitido, impunctato; elytris sat nitidis, fortiter haud dense punctatis, costis 7 vel 8 lævibus irregularibus, postice oblitteratis; pygidio fortiter punctato, corpore subtus parce punctato, tarsorum posticorum articulo primo quam secundum paulo longiori: ♂, clava antennali longa quadriarticulata, pilosa, articulo primo ceteris vix breviori.

Long. 8-9 mm.; lat. max. 4.5-5.5 mm.

WAIGEU I.: Camp Nok, 2500 ft. (*Miss L. E. Cheesman*, April, May). JAPAN I.: Mt. Eiori, 2000 ft. (*Miss Cheesman*, Sept.).

Numerous females were taken in April and May, and a single male in September. The smooth unpunctured scutellum and shining, irregularly costate elytra, strongly but not densely punctured between the costæ, distinguish this from the other known species of the genus. The front margin of the broad clypeus is almost straight, but when looked at from behind appears very feebly prominent in the middle owing to the slight elevation of the reflexed edge. The front angles of the pronotum are sharply produced, and the hind angles obtuse. The club of the antenna of the male is composed of four joints, which are rather long and completely clothed with soft projecting hairs.

Menigionyx flabellatus, sp. n.

Niger vel piceo-niger, antennis, pedibus corporeque subtus flavescens; oblongus, parum convexus, capite et pronoto dense fortiter punctatis, elytris fortiter haud dense punctatis, nitidis; clypeo crebre haud dense punctato, lato, margine antico fere recto; pronoti margine laterali vix arcuato,

medio obtuse angulato. angulo antico paulo producto, postico obtuso, scutello punctato; elytris grosse sat crebre punctatis, punctis plurimis seriatim ordinatis. lineisque longitudinalibus haud carinatis lævibus; pygidio ruguloso, postice longe haud crebre piloso, tarsorum posticorum articulo primo quam secundum vix longiori.

♂, oculis magnis, antennarum clava longissima, triphylla, pilosa.

Long. 6-7.5 mm.; lat. max. 3.5-4 mm.

DUTCH NEW GUINEA: Bewani Mts., 1300 ft., Humboldt Bay Distr. (W. Stüber, July, Sept.); Pukusam, W. of Tami R. (W. Stüber, June).

I have recognized no females of this species, of which there are four males. The two sexes probably differ considerably. The broad head and prominent eyes of the male, in conjunction with its general shape, produce a resemblance to the Rutelid genus *Adoretus*. The great development of the antennæ in this sex is also a peculiar feature. The three long lamellæ are clothed upon their whole surface with soft outstanding hairs. The pronotum and posterior part of the head are closely punctured, usually with a vestige of a narrow smooth median line upon the pronotum, and the remaining surface is shining, the elytra strongly but not closely punctured in imperfect rows, leaving about six smooth longitudinal lines, which are not at all elevated as in most of the species. The pygidium is roughly punctured and its posterior half is clothed with long hairs. The legs are very pale, the tarsi fairly long and the first joint in the hind feet only a little longer than the second.

Menigionyx nasutus, sp. n.

Niger, corpore subtus rufescenti, antennis pedibusque flavis; oblongo-ovatus, convexus, supra opacus, capite et pronoto densissime punctatis, clypeo antice anguste lævi, nitido, margine rotundato, medio angulatim elevato; pronoti lateribus arcuatis, angulis anticis acutis, posticis valde obtusis, scutello punctato medio lævi; elytris fortiter sat crebre æqualiter haud seriatim punctatis; pygidio grosse et dense punctato, apice nitido; corpore subtus grosse sat parce punctato, apice piloso; tarsorum posticorum articulo primo quam secundum paulo longiori.

Long. 5-6 mm.; lat. max. 3-3.5 mm.

WAIGEU I.: Camp Nok, 2500 ft. (Miss L. E. Cheesman, April).

Numerous specimens taken at light are all apparently females. It is a small species, easily recognized by the clypeus being distinctly pointed in the middle. This is due to the angulation of the reflexed part of the front margin only and is therefore not visible when looked at from immediately above. It is more pronounced than the very feeble angulation in *M. laeviscutum*. With the exception of the narrow smooth margin of the clypeus, the upper surface of the body is strongly and closely punctured, the head and pronotum very densely, the elytra not densely but rather evenly, each puncture having a minute central granule. The pygidium and lower surface are rather coarsely punctured, the former densely and the latter sparsely.

Menigionyx rectangularis, sp. n.

Niger, pedibus, antennis corporeque subtus rufescentibus; oblongo-ovatus, convexus, modice nitidus, capite dense punctato, clypei margine antico rotundato: pronoto fortiter, medio sat crebre, lateraliter densius punctato, lateribus haud arcuatis, pone medium angulatis, antice et postice fere rectis, angulis anticis acutis, posticis rectis; elytris leviter costatis, inter costas sat crebre punctatis; pygidio grosse fere rugose corporeque subtus parce punctatis; tarsorum posticorum articulo primo quam secundum paulo longiori.

Long. 6-7 mm.; lat. max. 4 mm.

DUTCH NEW GUINEA: Bewani Mts., 1300 ft., Humboldt Bay Distr. (*W. Stüber*, July). Cyclops Mts., 3400-4500 ft. (*Miss L. E. Cheesman*, March).

JAPAN I.: Mt. Eiori, 2000 ft. (*Miss L. E. Cheesman*, Sept.).

With the exception of *M. nasutus*, this is the smallest species of the genus. It is distinguished from the rest by the hind angles of the pronotum, which, instead of being very blunt, are almost right angles. Unlike *M. nasutus*, it is rather shining above, the upper surface strongly punctured but not densely, except upon the head and the sides of the pronotum. The clypeus is simply rounded, the sides of the prothorax not rounded but angulated near the middle and straight to the well-marked front and hind angles, the former a little produced. A narrow, smooth, unpunctured area is generally to be found in the middle of the pronotum, and the scutellum is smooth

in the middle but punctured at the sides. The elytra bear rather ill-defined feebly elevated smooth lines, between which they are closely punctured, each puncture, as well as those upon the head and thorax, having a central granule. The pygidium is coarsely and rather rugosely punctured and the lower surface of the body coarsely and sparsely.

Menigionyx ovalis, sp. n.

Niger, opacus, corpore subtus pedibusque piceis; ovalis, valde convexus, capite convexo, dense punctato, clypeo lato, punctato-rugoso, margine arcuato; pronoto fortiter et dense punctato, lateribus bene arcuatis, angulis anticis vix acutis, posticis obtusis, scutello parce et minute punctato; elytris latis, crebre et grosse punctatis, costis lævibus dorsalibus tribus duabusque vel tribus ab humeris orientibus; pygidio crebre punctato-rugoso, corpore subtus fortiter, metasterni medio haud fortiter punctato; pedum posteriorum articulo basali quam secundum fere duplo longiori. Long. 6.5-7 mm.; lat. max. 4 mm.

WAIGU I.: Mt. Nok, 2500 ft. (Miss L. E. Cheesman, April. May).

Eight specimens of this species appear to be all females. It bears a close resemblance to *M. byrrhoides* and has the same broadly oval shape, but it is a little smaller, the upper surface is rather less dull, the head less flat, the clypeus less distinctly punctured, the scutellum feebly punctured and shining, the pronotum and elytra are a little less closely and coarsely punctured, and the elytral costæ less sharp and prominent. The puncturation of the lower, as of the upper, surface is less coarse and the metasternum, especially in the middle, is more shining. The basal joint of the hind tarsus is nearly twice as long as the second.

Menigionyx byrrhoides, sp. n.

Niger, opacus, corpore subtus cum pedibus piceis, antennis flavidis; ovalis, valde convexus, fortiter et dense punctatus, capite plano, clypeo lato, dense punctato, margine arcuato; pronoto grosse et dense punctato, lateribus fortiter arcuatis, angulis anticis paulo productis, posticis obtusis, scutello fortiter punctato; elytris latis, grosse et crebre punctatis, costis angustis lævibus, quarum tribus dorsalibus, duobus humeralibus et duobus lateralibus; pygidio grosse et

crebre punctato, corporeque subtus grosse et fortiter, lateraliter sat crebre, punctato; tarsorum posteriorum articulo primo quam secundum fere duplo longiori.
Long. 7.5–8.5 mm.; lat. max. 5 mm.

DUTCH NEW GUINEA: Bewani Mts., 1300 ft., Humboldt Bay Distr. (*W. Stüber*, July).

The five specimens appear to be females. The species is recognizable by its shortly oval, highly convex and entirely dull upper surface and strongly costate elytra. The head is flat, the clypeus evenly rounded and strongly punctured, the pronotum very coarsely and densely and the scutellum strongly punctured. The pronotum and scutellum have each an imperfect, narrow, smooth median line. The elytra are strongly and closely punctured, with narrow, strongly elevated costæ. The coarsely and closely punctured pygidium has usually, like the pronotum and scutellum, a narrow, elevated, smooth median line. The lower surface is very closely and deeply and at the sides rather closely punctured. The antennæ are very short.

Menigionyx carinatus, sp. n.

Niger, sat nitidus, antennis, pedibus corporeque subtus rufis; oblongo-ovalis, convexus, capite fortiter sat dense punctato, clypei margine antico fere recto; pronoto fortiter inæqualiter haud dense punctato, dimidio postico medio longitudinaliter carinato, carina lævi, angulis anticis et posticis leviter impressis, illis vix acutis, his obtusis, scutello lævi, impunctato; elytris sat parce fortiter punctatis, punctis vix seriatim ordinatis, lineis longitudinalibus 5 vel 6 dorsalibus irregularibus lævibus, utroque elytro pone scutellum fortiter transverse carinato; corpore subtus fortiter et parce, pygidio fortius atque crebrius, punctato, apice parce ciliato.

Long. 9 mm.; lat. max. 4.5 mm.

DUTCH NEW GUINEA: Bewani Mts., 1300 ft., Humboldt Bay Distr. (*W. Stüber*, July); Pukusam, W. of Tami River, Humboldt Bay Distr. (*W. Stüber*, June).

Three specimens of this curious species were found. A number of peculiar features render it quite unmistakable. It is quite black above, with red legs and lower surface. The head and pronotum are strongly and moderately closely, but not densely, punctured, the scutellum is entirely smooth and shining, and the elytra are shining,

but with large scattered punctures, not forming rows but with a few narrow ill-defined, smooth, longitudinal lines amongst them. In the middle of the pronotum there is a narrow longitudinal ridge, extending from the base to a little past the middle, and each elytron bears a short transverse ridge near the scutellum and level with its apex, extending from about the middle of the elytron to near the suture. The pygidium and lower surface are shining and bear large but not numerous punctures. The basal joint of the hind tarsus is $1\frac{1}{2}$ times as long as the second joint.

Menigionyx pallidus, sp. n.

Rufus, nitidus, parce punctatus, capite obscuro, elytris, abdomine, pedibus antennisque pallide flavis; breviter ovalis, convexus, clypeo dense punctato, margine rotundato, medio fere recto, fronte et pronoto minute parce punctatis, hujus angulis anticis productis, posticis obtusis; elytris parce sed distincte vix seriatim punctatis; pygidio rugose punctato, apice longe piloso; corpore subtus lævi, fere nudo, parcissime punctato, abdominis apice rugoso, longe piloso, acuto; tarsorum posticorum articulo primo quam secundum fere duplo longiori.

Long. 7.5 mm.; lat. max. 4 mm.

N.E. NEW GUINEA: Garaina, 2500 ft., Upper Waria River (*F. Shaw Mayer*).

This is the only species of the genus at present known from the eastern part of New Guinea. It is very aberrant in its pale colour and scantily punctured smooth and shining upper surface, but has the structural features of the genus. It is of short oval shape, with the clypeus and pygidium alone strongly punctured, the former closely, its margin almost straight in the middle, the forehead and pronotum finely and scantily punctured, the front angles of the latter produced, the hind angles blunt. The scutellum is almost unpunctured, the elytra very distinctly but rather sparingly and the pygidium coarsely and closely, its apex clothed with long hairs.

The single specimen is probably a female.

Genus APOGONIA.

This genus, one of the most abundant and characteristic amongst the Old World Melolonthidæ, more than 300 species being already known, is especially well-represented

in the Malayan Region, but appears to reach its eastern limit in New Guinea, where few forms have as yet been found. It has, perhaps, not reached the eastern part of the island. Only three species have so far been described, *Apogonia arta* Karsch, *papua* Lansb. and *alkmaarensis* Heller. A fourth, from central New Guinea, is now added. Of *A. papua* the British Museum collection possesses typical examples, and *A. alkmaarensis* I believe to be extremely closely related to it and scarcely differing, except by its rather larger size and the absence of a lateral carina to the abdomen, which is present in *A. papua*. Both these forms were found by Miss Cheesman in Waigeu Island, as well as a third species, which is here described. Of *A. arta* we are told only that it measures 7·3 by 4 mm., is brassy black, well punctured, with emarginate clypeus, costate elytra and bidentate front tibiae. Its recorded habitat is New Guinea only.

These five Papuan species may be tabulated as follows:—

1 (6). Front tibia tridentate.	
2 (5). Short.	
3 (4). Abdomen carinate at the sides	<i>papua</i> Lansb.
4 (3). Abdomen not carinate at the sides	<i>alkmaarensis</i> Hell.
5 (2). Elongate	<i>waigeana</i> , sp. n.
6 (1). Front tibia bidentate.	
7 (8). Front margin of the clypeus straight.	<i>centralis</i> , sp. n.
8 (7). Front margin of the clypeus emarginate . .	<i>arta</i> Karsch.

Apogonia waigeana, sp. n.

Obscure cuprea, nitida, angusta, capite et pronoto ubique fortiter sat crebre punctatis, clypeo rugose punctato, margine antico late et subtiliter exciso; pronoti lateribus antice rectis, angulis productis, vix acutis, postice rotundatis, angulis obsoletis, margine basali leviter arcuato, haud lobato, scutello parce et minute punctato; elytris fortiter et æqualiter punctatis, parte dorsali leviter angustetricostato, costa prima juxta-suturali; pygidio grosse et profunde punctato, corporis subtus lateribus crebre et grosse, medio parce et minute punctatis: tibiis anticis sat fortiter tridentatis.

Long. 7·5 mm. : lat. max. 4 mm.

WAIGEU I. : Camp Nok, 2500 ft. (*Miss L. E. Cheesman*, April).

Three specimens of this species were collected at light. It has the size, and apparently the shape and colour, of *A. arta* Karsch, but differs in its three-toothed front tibiae. From the remaining Papuan forms it differs

entirely. It is much smaller, more parallel-sided, of peculiarly narrow shape and more strongly punctured, with more distinctly costate elytra. The head is relatively broader, the pronotum less narrowed in front, with its lateral margins more strongly rounded behind and hind angles non-existent. The elytral puncturation is much stronger and more regular and the costæ are narrower, distinctly, although feebly, elevated and complete from base to apex.

Apogonia centralis, sp. n.

Cupreo-nigra, clava antennali flava; ovata, convexa, clypeo rugose punctato, margine antico fere recto, lateribus rotundatis, fronte fortiter punctato; pronoto fortiter, lateraliter sat crebre medio parcius, punctato, lateribus arcuatis, angulis anticis productis, vix acutis, posticis obtusis, basi arcuato, medio vix producto, scutello lævi; elytris sat fortiter haud dense punctatis, dimidii antici seriebus geminatis parum distinctis, lateribus seriatim, apicibus rugose punctatis; pygidio profunde rugoso, metasterni medio lævi, impunctato, lateribus crebre punctatis abdomineque subtus sat crebre punctato, lateribus haud carinatis; tibiis anticis bidentatis.

Long. 11.5 mm.; lat. max. 6.5 mm.

CENTRAL NEW GUINEA: Middle Fly River, 250 to 300 miles from the mouth.

A single specimen, taken in July 1928 by an unknown collector, was sent to me by Mr. F. C. Hadden. It closely resembles *A. alkmaarensis* Hell., but is easily distinguished by the bidentate front tibiæ, as well as the more strongly punctured head and pronotum. The former bears large deep punctures upon every part, fairly close upon the forehead and dense upon the clypeus, the front margin of which is scarcely perceptibly excised. The pronotum bears numerous large deep punctures at the sides, which change to fine and sparse ones in the middle. The lateral margin is not straight in its anterior half, as in *A. alkmaarensis*, but gently rounded, and the front angles, although produced, are not very sharp, as in that species. The scutellum is very smooth, the elytra are finely and rather sparingly punctured, and the pygidium is closely and deeply rugose. The punctures of the lower surface are stronger than in *A. alkmaarensis*, and the sides of the abdomen much less finely and closely punctured.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 40. APRIL 1941.

XX.—*Mallophaga Miscellany*.—No. 2. By THERESA CLAY, B.Sc., and Colonel R. MEINERTZHAGEN.

1.

IN the 'Zeitschrift für Parasitenkunde,' Bd. ii. Heft i. July 1939, pp. 47-57, Dr. Kéler mentions a number of generic names, giving genotypes but no descriptions. Dr. Jordan has kindly explained that these names are invalid according to Article 25 of the International Rules of Zoological Nomenclature, which states (paragraph c): "But no generic name nor specific name, published after December 31, 1930, shall have any status of availability (hence also of validity) under the Rules, unless and until it is published either

"(1) with a summary of characters (.....) which differentiate or distinguish the genus or the species from other genera or species :

"(2) or with a definite bibliographic reference to such summary of characters."

In order to avoid confusion, and for the sake of those authors who, like Dr. Kéler, can see no use for the International Rules, these genera will be described using, if possible, the original names.

Craspedonirmus.—Described below.

Ann. & Mag. N. Hist. Ser. 11. Vol. vii. 22

Acronirmus.—The creation of this genus for the *Brueelia* from the Swallow seems to be unjustified.

Neodocophorus.—The creation of this genus also seems unjustified. The owls are parasitized by a number of rather diverse species, but on consideration of a number of these it is apparent that the species are not generically distinct. The whole group of species are interconnected and exhibit common generic characters. The separation of the *cursor* group of species from *heteroceros* (*Strigiphilus*) is not justified merely on the absence of sexual dimorphism of the antennæ and the smaller size of segment IX of the male abdomen, nor can *celebrachys* (*Eustrigiphilus*) be conveniently separated, as there are intermediates which link up this rather distinctive species with the *cursor* group. It seems, therefore, to be more satisfactory to keep all these species in one genus, namely, *Strigiphilus* Mjöberg, 1910.

Aneutalus.—This is apparently a synonym of *Oiconiphilus* Bedford, January 1939.

Sclarisoma.—This may prove to be a good genus.

Colpocarenum.—This is apparently a synonym of *Ardeiphilus* Bedford, January 1939.

AMBLYCERA

2. *MACHÆRILÆMUS* Harrison, 1915.

Machærilæmus Harrison, Parasitology, vii. 1915, p. 389. Genotype : *M. latifrons* Harrison, 1915.

Hirundæcus Ewing, Proc. U.S. Nat. Mus. vol. lxxvii. art. 20, 1930, p. 12. Genotype : *H. americanus* Ewing, 1930.

Harrison (1916) in "The Genera and Species of Mallophaga" included in *Machærilæmus* only two species; these are distinguished, amongst other characters, by the broad head, absence of slit in front of eye, and by the presence of lateral processes on the gular plate. Malcomson Ann. Ent. Soc. Amer. vol. xxx. no. 1, 1937, p. 55) showed that *Menopon mæstum* Kellogg & Chapman should be included in *Machærilæmus*, and also described a new species, *M. complexus*, in which the gular plate has no lateral processes. It is apparent from a consideration of these species and from an examination of a male specimen from *Hirundo daurica erythropygia* and of a drawing of the ventral aspect of *Hirundæcus americanus*, kindly sent by the U.S. National Museum, that specimens

from the Hirundinidæ (*Hirundæcus* Ewing) cannot be separated generically from *Machærilæmus*. Thus specimens from the Hirundinidæ are indistinguishable from typical *Machærilæmus* in the head characters, having the gular plate as in *complexus* Malcomson, in the characters of the prosternal plate and the male genitalia, and in the absence of patches of setæ on the third femora and abdominal sternites and the presence of sternal spines.

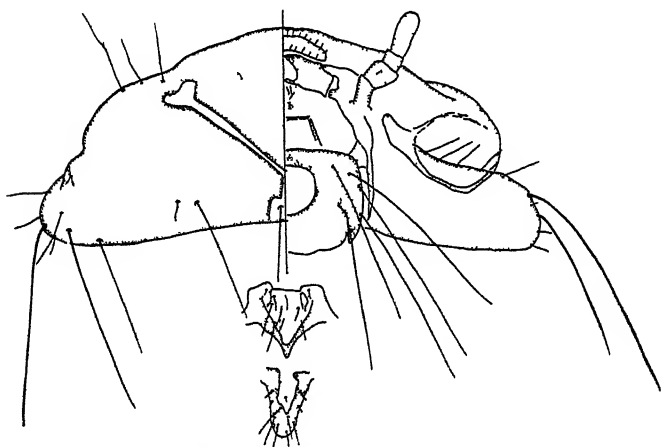
Machærilæmus as now understood is defined below, and should include the following species: *laticorpus* Carriker, *latifrons* Harrison, *mæstum* Kellogg & Chapman, *ploci* Bedford, *complexus* Malcomson, *americanus* Ewing, and probably *malleus* Burmeister. The species *urocolius* Bedford, originally placed in *Machærilæmus*, cannot be included in the genus (see below).

Description.—Head broad, being twice as wide as long or more (C.I. ♂♂, 2.08–2.18; ♀♀, 2.10–2.66); sides of forehead swollen and lateral margins entire. Deep pouch-like antennal fossa in which lie the last segments of the antennæ, making it impossible to distinguish their characters without dissection (material insufficient). Dorsal margin of head with Y-shaped suture, the stem of which arises at the middle of the occiput, the arms running out to meet a circular uncoloured area near each side of anterior margin (fig. 1)*. Gular plate large and not fused to chitinous framework which gives the articulation of the mandibles; central perforation may be present or absent, and the lateral margins either have a stout, backwardly projecting process each side (*laticorpus*, *latifrons*, and *ploci*) or an irregular outline with small distal process (new undescribed species from *Aphelocoma sieberi*), or the lateral margin is somewhat swollen anteriorly, without definite process (*complexus* and *americanus*). Prothorax broad and winged; prosternal plate characteristic (fig. 1). Mesonotum small and separated by narrow suture. Third femora without combs or patches of setæ. Abdomen broad, tergal plates entire, with a single row of marginal setæ and a few spines laterally; paratergal plates without internal thickening. Sternal plates narrow, with two irregular rows of setæ; there are no combs

* Figs. 5–10, 14, and 15 were drawn by Mr. R. S. Pitcher: figs. 3, 4, and 11 by Miss E. C. Humphreys; and figs. 1, 2, 12, 13, and 16 by Miss Theresa Clay.

or patches of setæ, but sternites II–VIII have 1–6 short stout spines on the postero-lateral angles of the plates, the latter being sometimes slightly produced posteriorly.

Fig. 1.



Machærilæmus laticarpus (Carriker). ♀.

Genitalia with elongated, somewhat flattened basal plate, free paramera, and bluntly pointed mesomal plate.

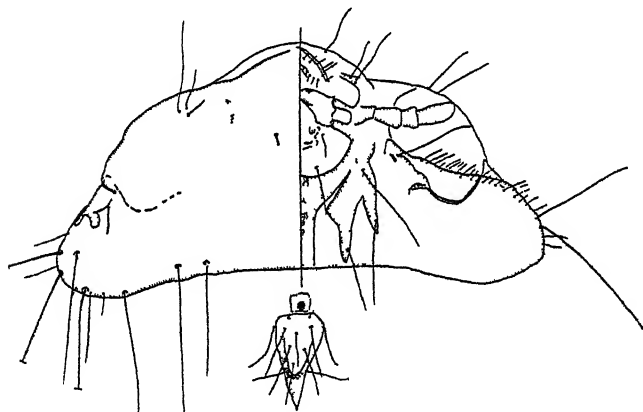
Distribution.—Apparently confined to the Passeres, where it is uncommon.

3. COLIMENOPON, gen. n.

Superficially this genus is similar to *Machærilæmus*, but is distinguished by the presence of a slit in the lateral margin of the head, the form of the ventral processes, and by the presence of patches of setæ on the abdominal sternites.

Description of the Genus.—Stout-bodied Menoponidæ with the following diagnostic characters:—Head broad (C.I. ♂♂, 2.00–2.10; ♀♀, 1.95–2.36), with lateral dorsal margin of head overlapping ventral continuation of temple margin to a considerable extent. Lateral corners of forehead swollen; lateral dorsal margins with narrow slit and fold in front of eye (fig. 2) ocular blotch absent. Antennal fossæ backed up by lightly chitinated area; antennæ four- (or possibly five-) segmented, with last segment short and capitate. Mandibles bidentate;

pharyngeal sclerite rudimentary. Gular plate small, with central perforation (not known in Bedford, Rep. Dir. Vet. Serv. Anim. Ind. U.S. Africa, 1930, p. 157, f. 4), and is fused to chitinous framework which gives the articulation of the mandibles; this framework is prolonged ventrally each side and gives rise to two backwardly directed processes. Prothorax large and winged, with characteristic prosternal plate. Mesonotum small. Third femora each with ventral patch of setæ. Abdomen with tergal plates entire, with a single row of marginal setæ. Paratergal plates without internal thickening. Sternites IV-VII with lateral patches of setæ. Genitalia with elongated



Colimenopon from *Colius macrourus pulcher*.

basal plate, lightly chitinized paramera, flattened mesosomal plate, and sac with teeth.

Genotype: *Machæritæmus urocolius* Bedford, 1930.

Type-host: *Colius indicus lacteifrons* (*C. i. transvaalensis*).

This genus appears to be restricted to the bird-genus *Colius*.

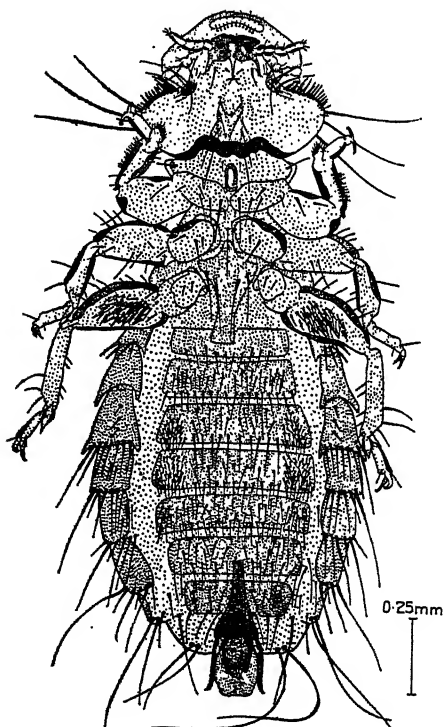
4. MEROMENOPON, gen. n.

This genus is distinguished by the characters of the head, paratergites, and ventral chaetotaxy.

Description of the Genus.—Somewhat elongated Menoponidæ with the following diagnostic characters:—Anterior

margin of head somewhat flattened centrally, with slight concavity before the swollen lateral corners of the forehead ; lateral dorsal margin with ocular emargination and small slit in front of well-developed eyes. Temples not greatly expanded and somewhat angular, the lateral margins being reclined towards occiput. Ocular blotch

Fig. 3.

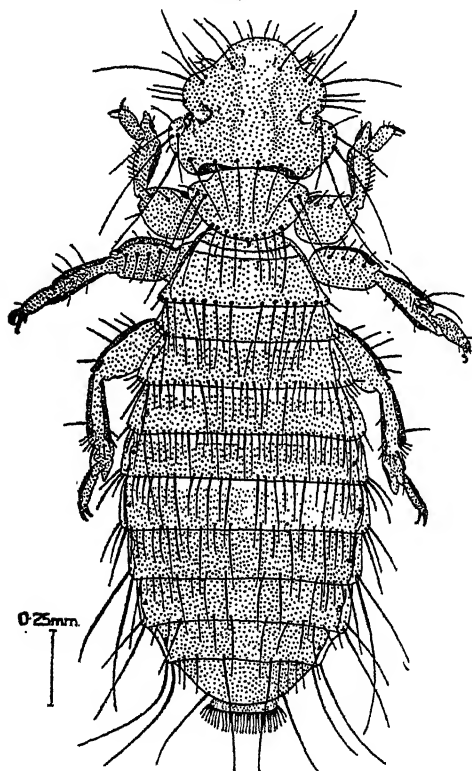


Meromenopon meropis, sp. n. ♂.

faint ; gular plate narrow, with small central perforation. Antennæ apparently 5-segmented, with the third segment small and the fifth capitate. Mandibles bidentate ; pharyngeal sclerite rudimentary. Prothorax winged ; prosternal plate with large central perforation. Mesonotum small and separated from metanotum by a distinct suture ; metasternal plate pointed anteriorly and narrowly

prolonged posteriorly. Third femora with closely set patch of setæ ventrally. Abdomen with tergal plates entire and with a single row of setæ. Paratergites without internal thickening and with posterior ventral corner of paratergites II-IV prolonged posteriorly as pointed processes. Sternal plates narrow, with many setæ; sternites

Fig. 4.



Meromenopon meropis, sp. n. ♀.

IV and V with lateral patches of closely set setæ. Genitalia with short basal plate, free paramera, and flattened mesosomal plate.

Genotype: *Meromenopon meropis*, sp. n.

Species of this genus have been examined from three species of the bird-genus *Merops* (Bee-eaters).

Meromenopon meropis, sp. n.

Description of Male.—With characters as given for genus and with ventral view as shown in fig. 3. Dorsal chaetotaxy as in female, but the abdominal tergites tend to have a greater number of marginal setæ.

Description of Female.—Similar in general appearance to male but somewhat larger. Characters as given for genus, with dorsal view as shown in fig. 4. Ventral chaetotaxy of head, thorax, and sternites I–VIII as in male, but with a greater number of setæ on sternites VII and VIII. Vulva with posterior margin convex and bearing 24–26 marginal hairs.

Measurements.

	Male.		Female.	
	Length.	Breadth.	Length.	Breadth.
	mm.	mm.	mm.	mm.
Head.....	0.415	0.555	0.430	0.600
Pronotum	0.224	0.384	0.236	0.415
Meso- and metanotum .	0.224	0.480	0.214	0.600
Abdomen	1.140	1.600	1.600	1.020
Total.....	2.000	—	2.480	—
C.I.	1.33	.....	1.39	.....

Described from 5 ♂♂ and 16 ♀♀ from *Merops apiaster* Linn. (Bee-eater) collected in Afghanistan.

Holotype.—♂ in the Meinertzhagen collection, slide no. 10086.

Paratypes.—4 ♂♂, 16 ♀♀.

5. ODORIPHILA, gen. n.

A distinct genus, distinguished from other known genera by the combination of the slit in front of the eye, in the presence of two chitinous processes each side of the mouth, and combs of spines on the third femora and third and fourth sternites.

Description of the Genus.—Somewhat stout Menoponidæ with the following diagnostic characters :—Lateral margins of head without ocular emarginations but with narrow slit in front of well-developed eyes. Ocular blotch present ; gular plate faintly chitinated. Antennal fossæ backed by chitinated area ; antennæ five-segmented, third short and fifth capitate. Mandibles bidentate ; labial palpi short ; pharyngeal sclerite rudimentary.

Two pairs of backwardly directed pointed processes arise near base of palpi, similar in character to the single pair found in *Menacanthus*. Prothorax winged; prosternal plate well developed. Mesonotum small and separated from metanotum by a suture; meso- and metasternal plates small. Third femora with two ventral combs.

Fig. 5.

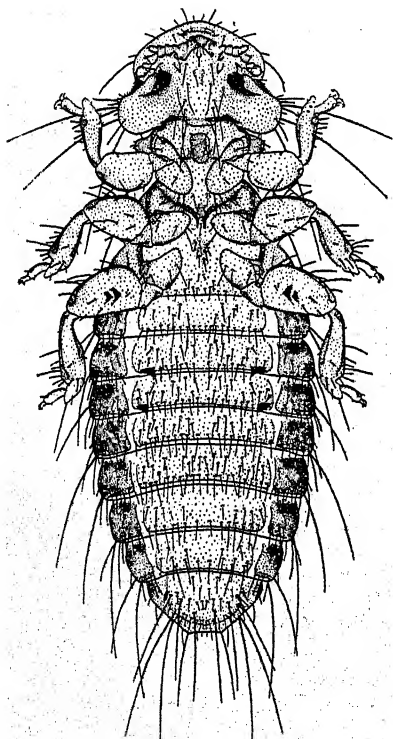


Fig. 6.

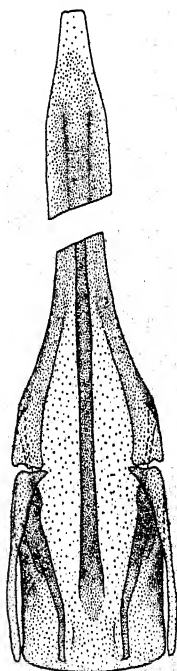
Fig. 5.—*Odoriphila phœniculi*, sp. n. ♂.

Fig. 6.—Ditto. ♂ genitalia.

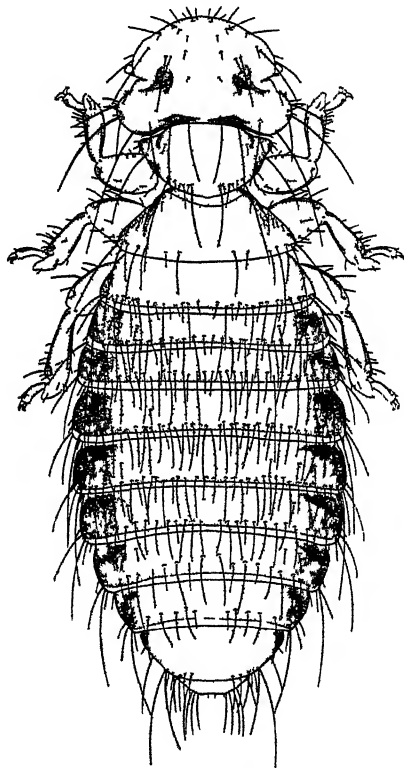
Abdomen with tergal plates entire and more heavily chitinized along the antero-lateral margins; each tergite with a single row of marginal setæ, and anterior to these there may be a few lateral setæ. Paratergal plates with internal thickening. Sternites III and IV with a single lateral marginal comb each side. Male genitalia with

elongated rod-like basal plate ; free paramera ; mesosomal plate with straight posterior margin and rod-like structure present associated with sac.

Genotype : *Odoriphila phoeniculi*, sp. n.

Specimens of this genus have been examined from two species of *Phœniculus* (Wood Hoopoe).

Fig. 7.



Odoriphila phoeniculi, sp. n. ♀.

Odoriphila phoeniculi, sp. n.

Description of Male.—With characters as given for genus and with ventral view as shown in fig. 5. Dorsal chaetotaxy as in female. Male genitalia with elongated rod-like basal plate reaching to the first abdominal segment (fig. 6).

Description of Female.—Similar in general appearance to male but somewhat larger. Characters as given for genus, with dorsal view as shown in fig. 7. Ventral chætotaxy of head, thorax, and of sternites I–VII as in male; sternite VIII has a greater number of setæ than in male. Vulva with posterior margin convex and bearing 12–16 setæ each side of mid-line.

Measurements.

	Male.		Female.	
	Length.	Breadth.	Length.	Breadth.
	mm.	mm.	mm.	mm.
Head.....	0.292	0.490	0.292	0.500
Pronotum	0.184	0.384	0.200	0.384
Meso and metanotum..	0.200	0.490	0.220	0.550
Abdomen	1.060	0.645	1.220	0.800
Total.....	1.740		1.840	
C.I.....	1.67		1.71	

Described from 38 ♂♂ and 37 ♀♀ from *Phœniculus bollei jacksoni* (Sharpe) (Wood Hoopoe) collected in Kenya.

Holotype.—♂ in the Meinertzhagen collection, slide no. 6251.

Paratypes.—37 ♂♂ and 37 ♀♀.

6. GRUIMENGPON, gen. n.

This genus is distinguished by the slight emargination in the lateral margin of the head, absence of slit and ocular blotch, and the presence of closely set patches of setæ on the third femora and fourth abdominal sternite.

Description of the Genus.—Menoponidæ with the following diagnostic characters:—Lateral dorsal margin of head, which overlaps ventral continuation of temple margin to a considerable extent, has a slight emargination but no slit or notch in front of well-developed eye. Antennal fossa backed up by chitinous area; ocular blotch absent, but there is a small dark area near the anterior end of the ventral continuation of temple margins and a pear-shaped clypeal blotch present each side of head. Antennæ five-segmented, with the third segment small. Mandibles bidentate; pharyngeal sclerite rudimentary. Gular plate not developed. Prothorax winged; prosternal plate rudimentary. Mesonotum small and not separated from metanotum by a definite suture. Third femora each with

a closely set patch of setæ ventrally. Abdomen with tergal plates entire and with a single row of marginal setæ ; paratergal plates more heavily chitinized than tergal plates and without internal thickening. Sternite IV with lateral patch of thickly set setæ each side. Last sternal plate of female abdomen apparently characteristic in having a deep median indentation. Male genitalia complicated, without elongated basal plate (fig. 9).

Fig. 8.

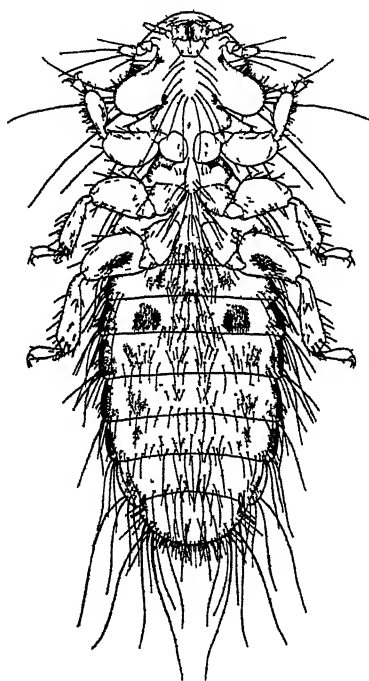


Fig. 9.

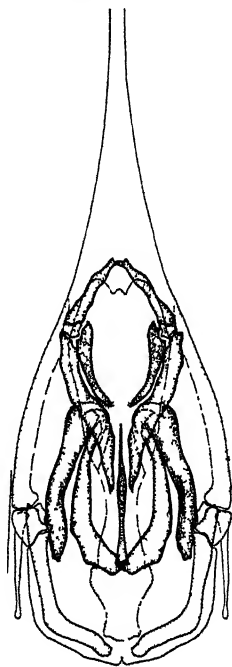
Fig. 8.—*Gruinenopon longum*. ♀.

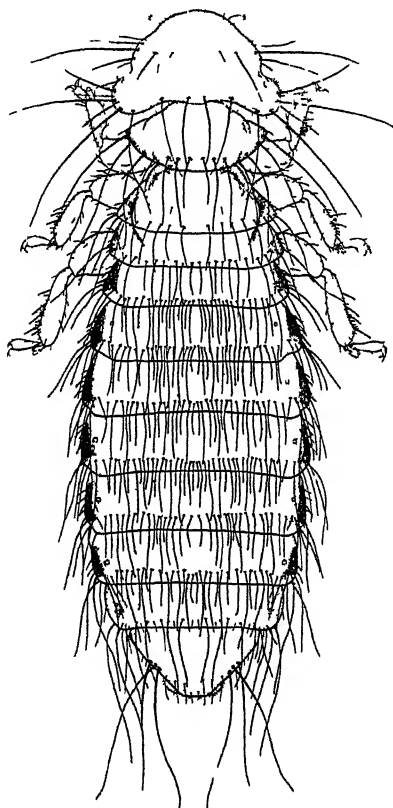
Fig. 9.—Ditto. ♂ Genitalia.

Genotype : *Menopon longum* Giebel, 1874. Host : *Megalornis grus*.

This genus has been examined from the following genera of the Gruidæ : *Anthropoides*, *Megalornis*, and *Balearica*. From the description, the species here figured (figs. 8-10),

from *Megalornis grus*, appears to be *Menopon longum* Giebel. As the type, if still in existence, is in the Halle

Fig 10.



Gruamenopon longum. ♀.

Museum, it is at the moment impossible to obtain any information about it.

ISCHNOCERA Kellogg.

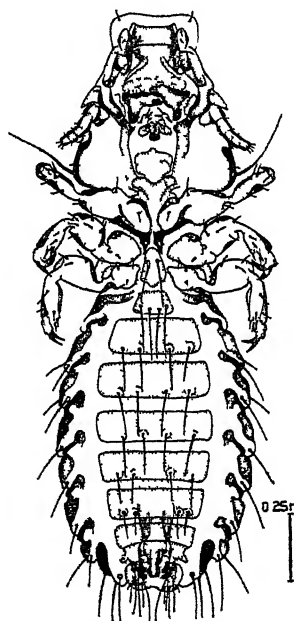
7. CRASPEDONIRMUS *, gen. n. (Fig. 11.)

This genus is distinguished by the characters of the clypeal region and abdomen.

* See p. 342.

Description of the Genus.—Stout, rather elongated Philopteridæ with the following diagnostic characters :—Head large, with hyaline margin arising at level of clypeal suture, clypeal signature large and flask-shaped; antennal bands pass in to form narrow clypeal suture posterior to signature on each side but not fusing medianly. Clavi large and projecting and similar in the two sexes; antennæ short and not sexually dimorphic. Hind head with dorsal

Fig 11

*Craspedonirnus colymbinus*. ♂.

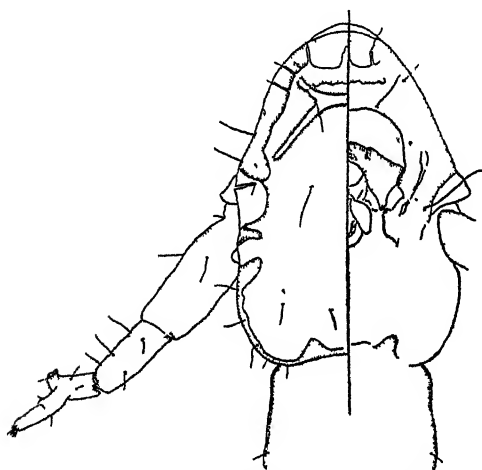
transverse suture; occiput with broad bands. Pharyngeal glands and sclerite small. Prothorax short; pterothorax with flattened, not divergent, lateral margins. Abdomen elongate and rather stout; segments I–VIII with continuous tergal plates; paratergal plates with elongated curved re-entrant heads of characteristic shape; sternal thickening in the form of median plates. In the female abdomen a curved ventral plate runs across each side of segments VIII and IX. Genitalia with distal end of paramera thickened and forked.

Genotype : *Philopterus colymbinus* (Denny) 1842.
Type-host : *Colymbus stellatus* (Red-throated Diver).

8. *SPLENDOROFFULA*, gen. n.

This genus is distinguished by the characters of the clypeal region of the head and by the terminal segments of the male abdomen.

Description of the Genus.—Elongated Esthiopterinae with the following diagnostic characters :—Clypeal region with narrow, somewhat hyaline flap along anterior margin of head ; clypeal signature appears to be fused each side to the clypeal bands, and in some species there appears



Splendoroffula corythæolæ, sp. n. ♂.

to be no definite signature but a continuous clypeal band round the anterior margin ; chitin of anterior part of pre-antennal region modified into a number of raised projections as in *Oxylipeurus* ; suture of pre-antennal region as shown in fig. 12 ; occipital bands may be present or absent ; post-antennal region of female with small dorsal suture each side. Clavi present, small in the female ; antennæ exhibiting sexual dimorphism. Pharyngeal sclerite and glands present. Prothorax small and rectangular ; pterothorax with straight or slightly divergent sides. Abdomen elongated, with segment I small ;

paratergites with or without re-entrant heads. Terminal segment in both sexes bilobed posteriorly ; in the male the last segment is somewhat modified ventrally and bears a clump of lateral setæ and a median backwardly directed process which is fused to or arises close to the fused sternal plates of segments VII and VIII as in *Oxylipurus*. Genitalia diverse in form.

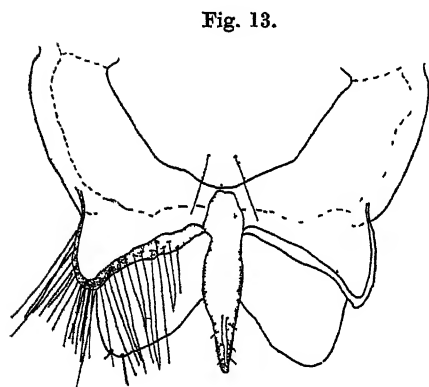


Fig. 13.



Fig. 14.

Fig. 13.—*Splendoroffula corythæolæ*, sp. n. ♂ abdomen.
Fig. 14.—Ditto. ♂ genitalia.

Genotype : *Splendoroffula corythæolæ*, sp. n.

This genus is apparently confined to the Musophagidæ and contains a number of rather diverse species. Some of these species have certain of the characters of the head, the terminal segments of the male and female abdomen and the male genitalia indistinguishable from *Oxylipurus*, but all species are distinguished from this latter genus

by the presence of the hyaline flap on the clypeus. Species of *Splendoroffula* have been examined from the following genera of the Musophagidæ: *Corythæola*, *Corythaixoides*, *Gallirex*, *Gymnoschizorhis*, *Musoghaga*, and *Turacus*. *Esthiopterum distinctum* Harrison, 1916 (*dispar* Piaget, 1885), is almost certainly this genus, but as it has been impossible to examine the type it has been thought more

Fig. 15.

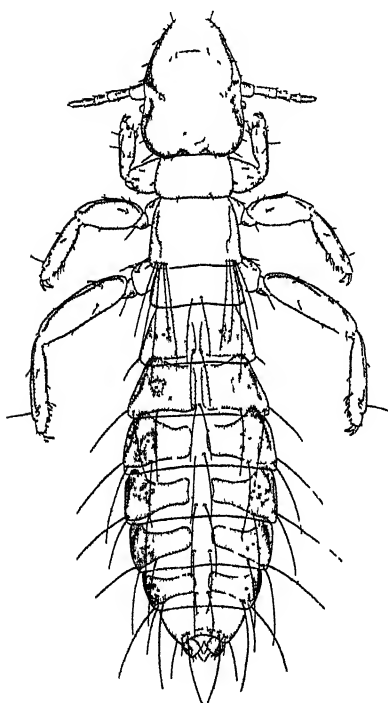


Fig. 16.

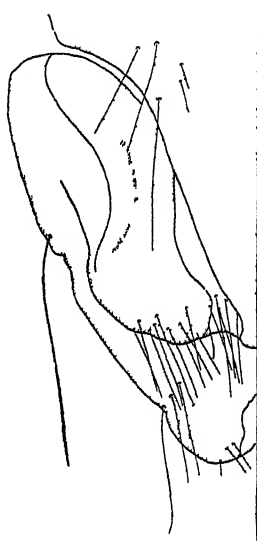
Fig. 15. -*Splendoroffula corythæolæ*, sp.n. ♀.

Fig. 16.- Ditto. ♀ Abdomen.

satisfactory to make a new species the genotype in the place of a doubtfully identified species. *Philopterus acuminatus* (Piaget), 1888 (type not examined), is not this genus and is probably a straggler. *Lipeurus opimus* Piaget, 1885 (type not examined), is not of this genus

but is probably from the host given by Piaget, as another similar species has been examined from *Crinifer zomurus*.

Splendoroffula corythæolæ, sp. n.

An elongated, well-chitinized species distinguished from other species of this genus by the characters of the clypeal region, the terminal segments of the abdomen in both sexes, and the male genitalia.

Description of Male.—Head as shown in fig. 12. Thorax similar to that of female (fig. 15), but with pterothorax somewhat longer; sternal plate oblong, with 2 or 3 setæ each side of distal end. Abdomen elongated, with tergal plates I–V not transversely continuous, although the inner margins of the two plates may approximate; paratergal plates narrow; sternal thickening in the form of median plates. Terminal segments of abdomen and genitalia shown in figs. 13 and 14. Dorsal chaetotaxy of thorax and segments I–VII as in female. On the ventral surface segments I–IV and VII and VIII have two central setæ; segments V and VI have two setæ each side of the central line; terminal segments as shown in fig. 13.

Description of Female.—Dorsal view as shown in fig. 15, with clypeal region as in male, sternites of segments VI–VIII being fused along their antero-posterior margins. Characters of genital region as shown in fig. 16.

Measurements.

	Male.		Female.	
	Length.	Breadth.	Length.	Breadth.
	mm.	mm.	mm.	mm.
Head.....	0.740	0.480	0.755	0.530
Prothorax	0.270	0.394	0.251	0.415
Pterothorax	0.400	0.495	0.383	0.540
Abdomen	2.230*	0.650	2.210	0.740
Total.....	3.640		3.590	
C.I.	0.65		0.70	

Described from 51 ♂♂ and 35 ♀♀ from skins and fresh material of *Corythæola cristata* (Vieill.) collected in Uganda, Nigeria, and Liberia.

Holotype.—♂ in the Meinertzhagen collection, slide no. 13407, from Uganda.

Paratypes: 50 ♂♂ and 35 ♀♀.

* Excluding ventral process.

XXI.—*A Fossil Skull of Hemibos from Palestine.*

By GUY E. PILGRIM, D.Sc., F.G.S.

[Plate IV.]

SOME years ago Bovine remains belonging to a single individual were discovered 20 metres below the surface of the ground during a well-excavation at Gadera (lat. $31^{\circ} 18'$ N., long. $34^{\circ} 47'$ E.) in Palestine, about 26 miles to the west of Jerusalem and about 7 miles from the coast. On receipt of the news Mr. Shalem, now of the Hebrew University, Jerusalem, with praiseworthy energy hastened to the spot in time to recover the greater part of the skeleton, including some of the more important portions of the skull, before the specimen had been completely broken up. Mr. Shalem left the skull at the British Museum with Miss D. M. A. Bate, who had his kind permission to describe it. Through pressure of other work she has not had the opportunity of doing so, but, knowing my interest in the group, has most kindly invited me to describe it on her behalf.

No definite information is obtainable as to the geology of the deposit. From Blanckenhorn's map of Palestine the locality seems to be situated on an outcrop which the author provisionally referred to the Upper Pliocene. The nature of the present Bovine specimen, though conveying no conclusive evidence of age, is not inconsistent with the correlation suggested. The genus *Hemibos*, to which the specimen belongs, has hitherto been known to occur only in the Pinjor stage of the Upper Siwaliks of India, equivalent to the Villafranchian stage of Europe, placed by some authorities in the Upper Pliocene and by others in the Lower Pleistocene. The Palestine species differs from each of the three Indian species of *Hemibos*, and since it seems to be more progressive than the latter the possibility of its being of a slightly later age than Villafranchian cannot be excluded.

The surface of the skull and preserved bones are of a pure white colour, quite firm and mineralized but relatively soft. Cavities such as the orbits, temporal openings, interior of the horn-cores are filled with a pale brown granular matrix, which was submitted to Mr. F. A. Bannister, of the Mineralogical Department of the British

Museum, for examination. He reports that "it is a calcareous sandstone—that is, sand cemented by calcium carbonate. The sand-grains are angular, and probably the rock is a recent aqueous formation." Presumably the calcite particles are the result of secondary crystallization.

DESCRIPTION.

Genus *HEMIBOS* Rùtimeyer ex Falc., MS.

Hemibos palæstinus, sp. n.

Diagnosis.—A *Hemibos* with exceedingly broad frontals, the width between the orbits exceeding the total length of the frontal; horn-cores far apart, very divergent, at an angle of probably as much as 135° , slightly curved, with an ovate cross-section, external contour rounded, primary keels absent, internal keel rounded, moderately produced inward; with rather narrow occipital condyles.

Holotype.—The skull from Gadera described and figured in the present paper.

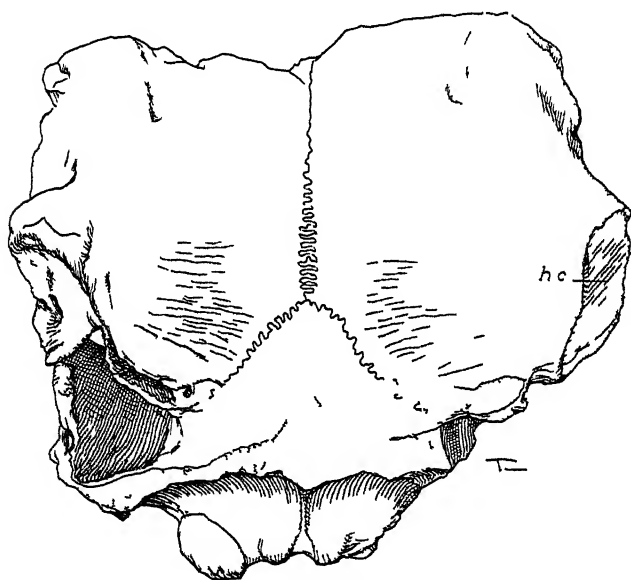
Description.—The skull from Gadera is poorly preserved. The frontal is fractured just about the level of the anterior border of the orbits, and everything in front of this is missing. The lower portion of the orbits is entirely broken away and the upper part of the orbital rim is everywhere defective, so that the breadth of the skull at the orbits cannot be measured accurately. The supraorbital pits and foramina are well shown. The base of the right horn-core is present; its shape can be observed approximately, but it seems to have lost some substance in the neighbourhood of the orbit, so that its actual size cannot be determined with certainty. Little of the left horn-core can be distinguished. A portion of the horn-core some 140 mm. in length is detached from the skull; it has no trace of union with the base as preserved on the skull, although it cannot be far above it. The greater part of the temporal fossa and part of the left zygomatic arch are preserved. The foramen magnum is well shown except for some chips off the lower right-hand corner. The lower portion of the occiput is preserved with the exception of the right occipital condyle and the paroccipital and mastoid processes on both sides. The upper portion of the occiput, probably above the supraoccipital suture,

is broken away, and with it the summit of the entire lambdoid crest. The upper surface of the parietal is also defective. For this reason the actual boundary between the temporal fossæ and the roof of the skull is not shown. The basicranial region is moderately well preserved, including the edge of the foramen magnum, the basi-occipital, and parts of both bullæ, which, however, lack their lower surface. The glenoid is preserved. Finally, portions of the right and left maxillæ are among the parts detached from the main skull. These do not join one another either across the centre of the palate or elsewhere. The cheek-teeth have been somewhat battered. The three molars on the left side are fairly perfect. P^4 has lost the outer half of its crown. P^3 and P^2 are only known by their roots. The right side has only the three molars and the alveoli of the three premolars remaining. The condition of wear of all the molars bears evidence of the fully adult age of the animal. Two cervical vertebrae were also among the parts of the skull left in London.

The frontal is strongly arched (text-figs. 1 & 2), the angle which it forms with the parietal surface being about 55° , which agrees nearly with that of the type of *Hemibos triquetricornis*, Brit. Mus. 39565, Brit. Mus. 36666, and Geol. Surv. Ind. K 14 742, where it is about 60° . In Brit. Mus. 16173 and Brit. Mus. 48032 it is rather less, about 50° . On the other hand, in *Bubalus bubalis*, Brit. Mus. 67.4.12.3, the angle is as much as 75° , and appears to be but little less than this in *B. platyceros* and Chinese fossil species of *Bubalus*, while in *Proamphibos* it varies from 30° to 40° . Its breadth is considerable. Approximately the width at the orbits may be estimated as 230 mm. This must exceed the total length of the frontal, and approaches the condition in *Bubalus bubalis*, where the same dimension is given as 247 and 254 mm. In the type of *Bubalus platyceros* it is said to be 236 mm., but in the American Museum skull of that species, A.M.19872, it is given as 265 mm. (see Pilgrim, 1937, p. 818). On the other hand, in *Hemibos triquetricornis* the width at the orbits does not reach more than 220 mm., so far as I am aware, while other specimens measure 207 mm. or less. For *Hemibos acuticornis* 200 mm. is recorded and for *H. antelopinus* only 188 mm. In the species

of *Hemibos* so far known the total length of the frontal exceeds the width. In *Proamphibos* the width exceeds the length of the frontal, as in *Bubalus* and the Palestine skull. The breadth at the constriction between the horn-core and the orbital rim is approximately 213 mm, and so very much greater than in the species of *Hemibos* so far known and the same as in the holotype skull of *Bubalus platyceros* (Lydekker 1878, p 129), though less than in the American Museum skull referred to that

Text fig 1



Hemibos palæstinus, sp. n. Holotype skull from Gadera
View from above h c, horn core One third natural size

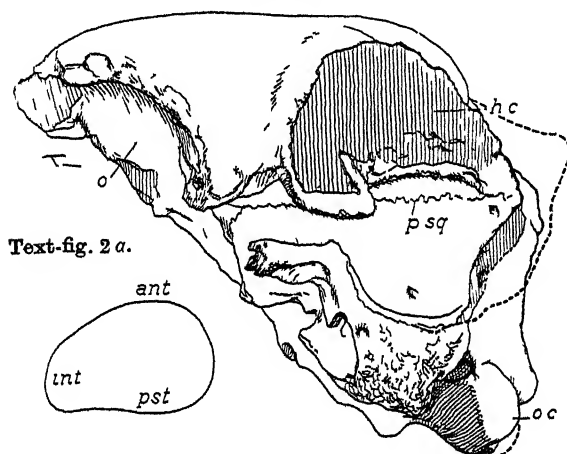
species (A M 19872), where it is 240 mm (Pilgrim, 1937, p 818) and in most of the skulls of *Bubalus bubalis*, both the recent Indian form as well as the variety *palæindicus* according to the measurements given by Van der Maarel (1932). A specimen of *Bison bonasus* has a corresponding dimension of 248 mm.

The broken condition of the orbits prohibits much knowledge of their shape or whether their roof projected

outwardly as is so markedly the case in *Hemibos triquetri-cornis*.

The horn-cores are situated at a considerable distance apart and are not far behind the orbits, so that, as in the *Bubalina* generally, they lie far below the plane of the occipital. They diverge at an angle of 135° approximately (Pl. IV. fig. 2), which is greater than in other species of *Hemibos* but less than in most species of *Bubalus*. In the Tamarau, *Bubalus mindorensis*, the divergence is even less. It is impossible to form any idea as to the

Text-fig. 2



Text-fig. 2.—*Hemibos palæstinus*, sp. n. Holotype skull from Gadera. View from left side. Restoration of the posterior end and the lambdoid crest in dotted lines. o., orbit; h.c., horn-core; o.c., occipital condyle, p.sq., parieto-squamosal suture. One-third natural size.

Text-fig. 2 a.—Cross-section of right horn-core at base. int., internal keel; ant., anterior side; pst., posterior side. One-third natural size.

amount of their backward tilt. Their cross-section is ovate, the inner keel (using the nomenclature suggested by me in 1939) being rounded, while the primary keels are non-existent. Although in many specimens of *Hemibos* the primary keels are quite distinct and the inner keel is sharp, yet in others, as, for example, Brit. Mus. 48032, supposed to be the female of the trochoceros form of

H. triquetricornis (see Rüttimeyer, 1878, p. 129) the cross-section is not unlike that of the Palestine skull. In *Bubalus bubalis* and in the Pleistocene species of *Bubalus* the inner keel is very sharp, and in many of them the primary keels absent. Moreover, the diameter of the horn-core between the inner keel and the centre of the outer edge is often twice as great as the maximum antero-posterior diameter. In the Palestine skull the ratio between these two diameters is about .73. In the holotype of *Hemibos triquetricornis*, Brit. Mus. 39565, it is approximately .83; in Brit. Mus. 48032, .75; in Brit. Mus. 36666, .85; in Geol. Surv. Ind. K 14 742, .66; and in Brit. Mus. 16173, 1.00. In *Bubalus platyceros*, *B. teilhardi*, and *B. mephistopheles* the primary keels are sharp and the ratio between the two diameters is little different from that of *Hemibos triquetricornis*. In other Pleistocene species of China, such as *B. wansjocki* and *B. brevicornis*, the two primary keels are sharp, but the ratio between the two diameters is nearer to that of *Bubalus bubalis*. It is probable that the varying contour of the cross-section of the horn-core is largely sexual. The Palestine skull is probably that of a female of the trochoceros form. The detached fragment of a horn-core is slightly curved and there is some indication of torsion.

The supraorbital pits are moderately large and deep (text-fig. 1). The foramen is single and situated at the hinder end of the pit, which does not extend backward. In front of the foramen the pit forms a rather broad depression which extends about 30 mm., but no furrow anterior to this exists. Corresponding to the great frontal width the supraorbital foramina are very far apart, 105 mm. as against 96 mm. in Brit. Mus. 48032. They are at least 60 mm. distant from the orbital rim, from which they are separated by a prominent shoulder more pronounced than in the Indian species of *Hemibos*.

Between the horn-cores and the supraorbital foramina the surface of the frontals is slightly concave.

That the parietal takes a considerable part in the roof of the brain-case is certain, but owing to the damaged condition of the posterior end of the roof it is impossible to do more than roughly estimate its length (text-fig. 2). It indents the frontals in a deep V-shaped suture, of which the tip of the V is well in advance of the hinder

end of the horn-cores. Approximately the distance in the mid-line between the fronto-parietal suture and the estimated summit of the occipital crest may be taken as about 75 mm., the corresponding lengths in Brit. Mus. 48032 and Geol. Surv. Ind. K 14742 as about 75 mm. and 80 mm. respectively, while in Brit. Mus. 16173 it is 87 mm. In a recent skull of *Bubalus bubalis* the length is 95 mm., but in *Bison bonasus* no more than 57 mm. The upper surface of the parietal can hardly be inclined at more than a right angle to the plane of the occipital, which agrees with most specimens of *Hemibos*. In *Bubalus* the angle is invariably much more obtuse. The parieto-frontal suture cannot be followed further than the edge of the roof of the brain-case, since the temporal fossa is broken off behind the suture. The well-marked suture which runs across the temporal fossa and loses itself in the broken lambdoid crest is the parieto-squamosal suture. It is, therefore, obvious that the upper and hinder margins of the temporal fossa are missing, so that it is not clear where it meets the roof of the brain-case. It is, however, certain that it opens broadly on to the parietal and supraoccipital equally, as in the *Bubalina* generally. In the *Taurina* and in *Leptobos* the opening is narrow on account of the great flattening of the skull. In *Bos* and the *Leptobovina* the temporal fossa opens on to the supraoccipital only, and in *Bison* only in small part on to the parietal as well.

The breadth of the Palestine skull at the mastoid can be only roughly estimated as 200 mm. This agrees very well with other species of *Hemibos*. In *Bubalus bubalis* this dimension is as much as 254 mm.; in *Bubalus bubalis* var. *palæindicus* as much as 305 mm.; in the British Museum skull of *Bubalus platyceros* (Brit. Mus. 16431) 246 mm. approximately; and in the American Museum skull referred to that species (A.M. 19872) 269 mm. A skull of *Bison bonasus* has a breadth of 245 mm.

The occipital condyles are rather narrow, although the breadth of the foramen magnum is fully equal to that of other species of *Hemibos*. They lie less far to the rear of the occipital crest than in Geol. Surv. Ind. K 14742 and other male skulls of the trochoceros form of *H. triquetricornis*.

The basioccipital is short, very broad, and markedly wedge-shaped (Pl. IV. fig. 1). This is due to the strong development of the posterior tuberosities, which recalls the condition in *Hemibos* rather than the *Taurina* or even *Bubalus*. On account of the great lateral expansion of these the contour between the occipital condyles and the posterior tuberosities of the basioccipital is deeply concave, forming almost a closed U. This is entirely different from either *Bubalus* or the *Taurina*, but agrees well with *Hemibos*. The lower surface of the basioccipital is slightly convex, but the sides ascend rather steeply. The anterior tuberosities are also prominent and only a narrow and deep gap is left between them.

The auditory bulla has lost its lower surface, so that the cellular structure of the interior is exposed. Its stoutness distinguishes it at once from any of the *Taurina* and to a smaller extent from *Bubalus*. It is also shorter than *Bubalus*. In every respect it seems to agree with *Hemibos*.

The glenoid surface is as usual in the Bovinæ. It is very broad transversely. The parieto-squamosal suture can be traced from the temporal fossa in front of the glenoid on to its lower surface.

The breadth of the palate as seen in front of P^2 and P^3 is greater than in *Hemibos*, and still more so than in *Bubalus bubalis*.

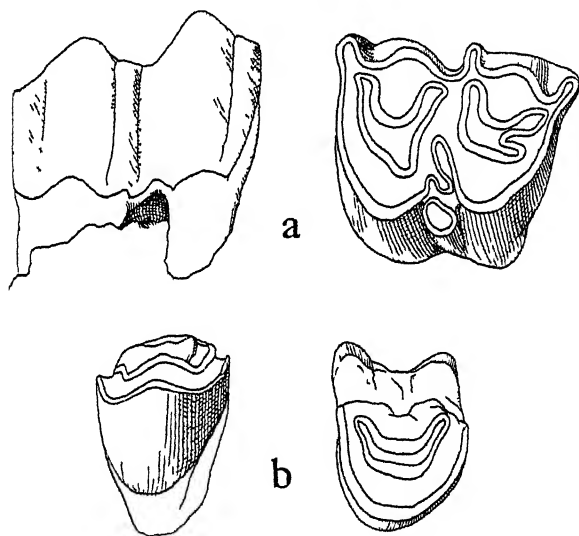
Dentition.—The bowing of the line of the upper cheek-teeth in the Palestine skull is very marked. This feature has not been noticed in the specimens of *Hemibos* examined nor in *Bubalus*. It may perhaps be associated with the much greater development of the muscle-ridge, which begins at P^2 and reaches a maximum in a tuberosity at M^1 , whence it ascends sharply and almost at right angles to the line of the teeth, causing a smooth depression in the front of the maxilla above the infraorbital foramen, which lies directly above P^2 and not in front of it as in *Bubalus*.

The upper premolar series is slightly more reduced than in *Bubalus bubalis*, and agrees with *Hemibos triquetricornis*.

The upper molar structure is typically Bovine (text-fig. 3), but by their more quadrate shape and by the development of stronger basal pillars they show affinities to the *Bubalina*.

rather than to the *Taurina* and the *Leptobovina*. In certain details they are nearer to the Villafranchian *Hemibos* than to the recent *Bubalus*. Thus they are much less hypsodont than in *Bubalus bubalis*. Comparing M^3 in the Palestine skull and in *Bubalus bubalis*, Brit. Mus. 67.4.12.3, which are as nearly as possible of the same size and degree of wear, the height of the former is 21 mm. as against 30 mm. in the latter. The same is true of the premolars, of which the respective height in these two skulls is 16 mm. and 25 mm. The folds which project into the fossæ of the molars in *Bubalus bubalis* are more

Text-fig. 3.



Text-fig. 3.—*Hemibos palæstinus*, sp. n. Last left upper molar and last left upper premolar of the holotype skull from Gadera. a. M^3 , external and surface views. b. P^4 , internal and surface views. Natural size.

numerous and longer than in the Palestine skull. In the posterior fossa of the former there is a long posterior fold and generally an anterior one as well, which almost join one another. The anterior fossa invariably has a long fold on the anterior side. In the latter the posterior fossa has only a short posterior fold and in the anterior

fossa it is entirely wanting. The Indian species of *Hemibos* show an equal deficiency of folds in the molars. *P*⁴ shows similar differences. In *Bubalus bubalis* at least one long fold projects into the central fossa, while the inner edge has a very marked fold. Neither of these is present in the Palestine *P*⁴. In most of the Indian specimens of *Hemibos* folds are equally absent. In Geol. Surv. Ind. K 14 742, however, there is a marked fold in the central fossa of *P*⁴.

Affinities.—The skull from Gadera clearly belongs to the Bubaline section of the Bovinæ. This is conclusively shown: (1) by the position of the horn-cores not far behind the orbits and considerably below the plane of the occipital; (2) by the relatively large part which the parietal takes in the roof of the brain-case and the comparatively large proportion which its length bears to that of the frontal; (3) by the subtriangular cross-section of the horn-cores, with a relatively great expansion of the inner keel to the inside; (4) by the wide opening of the temporal fossæ on to the roof of the brain-case, where they are in contact with the parietal as well as the supraoccipital; (5) by the quadrate shape of the upper molars and the strong development of inner basal pillars; (6) by the stout as against the laterally compressed shape of the auditory bulla. Of these characters numbers 3, 5, and 6 apply to all the Taurina, but in some degree *Bison* shares the others with the Bubalina. The Leptobovina differ in regard to numbers 3 and 4, while the curvature and approximation to one another of the temporal fossæ give their skull quite a different appearance from the one now being dealt with and from the Bubalina in general.

It is somewhat more difficult to decide to which of the genera of the Bubalina the Gadera species should be assigned. It might conceivably be regarded either as a primitive stage of *Bubalus* or as a progressive stage of *Hemibos*. Both genera, so far as our knowledge goes at present, appear at approximately the same time, in the Villafranchian, and appear to be descended from species of *Proamphibos* either in the Astian or the Pontian. Certain Chinese Pleistocene species of *Bubalus* as well as the Malayan living *Bubalus mindorensis* have retained characters, such as the small divergence of the horn-cores,

which are more primitive than those of *Bubalus platyceros* of the Villafranchian of India. It would seem that the two genera were pursuing a parallel evolution when in the case of *Hemibos* it came to an end with its extinction, unless the Palestine species should happen to be later than the Villafranchian. The most satisfactory distinction between *Hemibos* and *Bubalus* is to be found, I think, in the gradual deflection of the parietal into the plane of the occipital. This tendency exists in every species or *Bubalus*, in the Villafranchian *B. platyceros* no less than in the Pleistocene *B. mephistopheles*, *B. wansjocki*, *B. teilhardi*, and *B. brevicornis*, as well as in the living *B. mindorensis*. On the contrary, the parietal is almost of quite at right angles to the plane of the occipital in the Gadera skull as it is in most specimens of *Hemibos*.

By the greater relative size of the auditory bulla both in a longitudinal and a transverse direction the Gadera skull resembles *Hemibos* rather than *Bubalus*.

The teeth seem also to provide some basis for distinction. The absence of pronounced enamel folds projecting into the central fossae of the upper molars and P^4 distinguishes *Hemibos* from *Bubalus*. In this character the Gadera dentition agrees with *Hemibos*.

Although the different ratio between the two diameters of the horn-core mentioned above (p. 356) serves to distinguish *Hemibos* from many living and Pleistocene species of *Bubalus*, yet this hardly holds in the case of *Bubalus platyceros* and the Chinese Pleistocene species *B. mephistopheles* and *B. teilhardi* (see Young, 1936, p. 507). In these the internal expansion of the inner keel is little if any greater than in the Gadera skull. It must, however, be recalled that while the cross-section of the horn-core in this skull is quite different from that of *Hemibos acuticornis* and the normal form of *H. triquetricornis*, that of the trochoceros form of the latter species approaches it very nearly. Still more is this noticeable in the case of the female, as may be seen if the large male trochoceros form as exemplified in Brit. Mus. 48031, Geol. Surv. Ind. B 241 and K 14 742, be compared with the female of the same form, Brit. Mus. 48032. The cross-section in the last-named specimen is extremely like that of the Gadera skull, from which it is inferred

that the latter is a female. One point is noteworthy, the case of those species of *Bubalus* of which the horn-core section approaches that of *Hemibos*. While in the trochoceros form of *Hemibos* the primary keels of the horn-core are rounded or absent, in the species named they are sharp. This is a primitive feature, and seems to confirm my supposition that the lineages of *Bubalus* and *Hemibos* are quite distinct, so that the *Gadera* species, in spite of many developments parallel to those of *Bubalus*, is phylogenetically unconnected with it.

There is some reason to suppose that the horns of the *Gadera* species had but little curvature, but were slightly twisted, judging by the detached fragment. If so, this would be a difference from *Bubalus*, in which the horns are concave, curved upward, and without torsion.

CONCLUSION.

It is evident from the characters which we are able to observe in the *Gadera* skull that it cannot be regarded as conspecific with any previously known species of *Hemibos*. The chief characters referred to are the great breadth of the frontals and the well-spaced and widely divergent horns. These must be regarded as progressive, since they follow a line of evolution which has been observed not only in the genus *Bubalus* but also in other groups of Bovinæ. Whether this implies that the Palestine species is of later date than the Indian species is a matter of conjecture. If India itself was the radiative centre of the Bovinæ, then the failure to find such a form as *Hemibos palæstinus* in the Middle Pleistocene alluvial deposits of the Narbada would militate against such an opinion. If, however, the radiative centre of the Bovinæ were much farther to the west it would not be altogether surprising to find a progressive form of *Hemibos* in Palestine. But in that case such a form is as likely to have existed in the Villafranchian as in the Cromerian. It may be emphasized that the genus *Hemibos* has not been recorded out of Asia, so that no evidence from European or African sources can be called in to our assistance.

Measurements in millimetres of *Hemibos palæstinus*
and other Bovinæ.

	<i>Hemibos palæstinus</i> (Gadera).	<i>Hemibos tiquetricornis</i> .				<i>Bubalus bubalis</i> .		<i>Bubalus platyceros</i> , holotype, G. S. I. B. 237. (Lydekker, 1878, p. 129).	<i>Bubalus nephistopheles</i> (Young, 1936, p. 507).	<i>Bison bonasus</i> .
		Holotype, Brit. Mus. 39365, normal male.	Brit. Mus. 16173, normal female.	G. S. I. B. 241 (Lydekker, 1878, p. 142), trochoceros male.	Brit. Mus. 48032, trochoceros female.	Ind. Mus. (Lydekker, 1878, p. 136).	Brit. Mus. 67.4.12.3, small domestic female.			
Breadth of skull at orbits.	? 230	207	195	196	190	254	204	236	225	..
Breadth of skull at post-orbital constriction	? 213	176	164	175	177	239	172	213	155	248
Distance between supra-orbital foramina	105	92	99	119	96	135	115	114	85	145
Diam. of horn-core at base between inner keel and centre of outer face.	? 80	? 97	65	127	? 90	132	68	147	106	..
Max. ant. post. diam. of horn-core at base or between primary keels	? 58	? 81	65	76	? 68	64	44	84	74	..
Breadth of skull at mastoid	? 200	189	186	216	? 200	216	220	..	248	245
Breadth between outer edges of occipital condyles	94	102	99	..	110	129	99	..	..	109
Breadth of foramen magnum	? 38	..	32	..	..	..	40	..	..	43
Distance between post. ends of temporal fossæ . .	? 105	? 70	57	..	86	129	79	127	79	127
Breadth of basioccipital at post. tuberosities . . .	72	80	65	..	76	..	62	..	..	..
Breadth of basioccipital at ant. tuberosities	37	? 32	24	..	31	..	34	..	..	..
Auditory bulla long diameter (excl. styl. process)	? 53	? 49	..	..	? 41	..	46	..	..	40
Auditory bulla short diameter	? 26	? 19	..	..	? 20	..	22	..	..	13
Distance from for. lac. med. to edge of glenoid . .	74	69	? 64	..	67	..	68	..	..	83
Ant. post. length of molar series	87	85	90	..	..	..	88	..	..	..
Ant. post. length of pre-molar series	? 55	? 59	57	..	..	..	57	..	..	..
<i>M</i> ³ { ant. post. diam.	33	30	33	..	..	..	29	..	..	32
trans. diam.	28	28	28	..	..	..	26	..	..	22
<i>M</i> ² { ant. post. diam.	30	30	31	..	..	..	30	..	..	30
trans. diam.	28	28	32	..	..	..	27	..	..	23
<i>M</i> ¹ { ant. post. diam.	25	? 25	23	..	..	..	28	..	..	25
trans. diam.	27	? 26	27	26	23
<i>P</i> ⁴ { ant. post. diam.	? 18	19	19	19	19
trans. diam.	? 22	22	24	22	23

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EXPLANATION OF PLATE IV.

Hemibos palæstinus, sp. n. Holotype skull from Gadera.
Two-fifths natural size.

Fig. 1. Basicranial view.

Fig. 2. Posterior view.

XXII.—*Fijian Trichoptera in the British Museum.*

By MARTIN E. MOSELY, F.R.E.S., F.Z.S.

OUR knowledge of the Trichopterous fauna of Fiji is very scanty, not because these insects are actually scarce in the Islands, but because, up to the present, only three workers have concerned themselves with the group.

Brauer, in 1867, described three species. Banks, in 1924, three, and seven more in 1936, while the writer is responsible for two, whose descriptions were published in 1934.

In the present paper, five more are described, though it may be that two of them, *Goëra vuvula* and *Chimarrha indigota*, are synonyms of Bank's *Goëra fijiana* and *Chimarrha manni*, of which, unfortunately, no descriptions or figures of genitalia have been published, so that they remain unrecognizable.

There is some doubt as to the generic position of the species *greenwoodi* as neurulation, possibly aberrant in the single example available, seems to indicate *Polycerotropus* rather than *Polyplectropus*, the genus in which it has been here placed. Nevertheless, the former genus is practically unknown in the Pacific whereas *Polyplectropus* has been recorded abundantly, so that, until more material becomes available, it would seem more prudent to avoid the introduction of a doubtful generic record into the Fijian list. The description of *Achorema banksi* adds a new family, the Rhyacophilidæ, to the Fijian fauna.

The species *ruficeps* and *picea*, described originally by Brauer in *Hydromanicus* and subsequently, in 1907, transferred by Ulmer to *Hydropsychodes*, are now placed in the new genus *Abacaria*, since *Hydropsychodes* must be restricted to the genotype, *albomaculata*, a Central African insect. The species *Hydropsychodes fijiana*, which I described in 1934, is also to be transferred to this genus.

There remains, in the British Museum, a residue of specimens, some of which are certainly new, but which are either represented in the female sex only or are not in a condition for description. Chief among the females is a series of an insect strongly marked with black and

white in the anterior wings, which will doubtless prove to belong to *Abacaria* when confirmation can be obtained by the capture of a male and the examination of the genitalia. There are two female *Triænodes* which might be associated with any of the described Fijian males in the genus, and a third, undoubtedly new, with ochraceous anterior wings bearing a purple patch at the anastomosis. Seven specimens, badly attacked by mould, seem to belong to *Abacaria*, *Chimarra* and *Goera*.

The material dealt with in this paper has mostly been collected by correspondents of the Imperial Institute of Entomology and kindly presented by the Institute to the British Museum (Natural History).

Sericostomatidæ.

Goera vuida, sp. n. (Figs. 1-4.)

Insect with all parts ochraceous, antennæ brighter in colour than the wings.

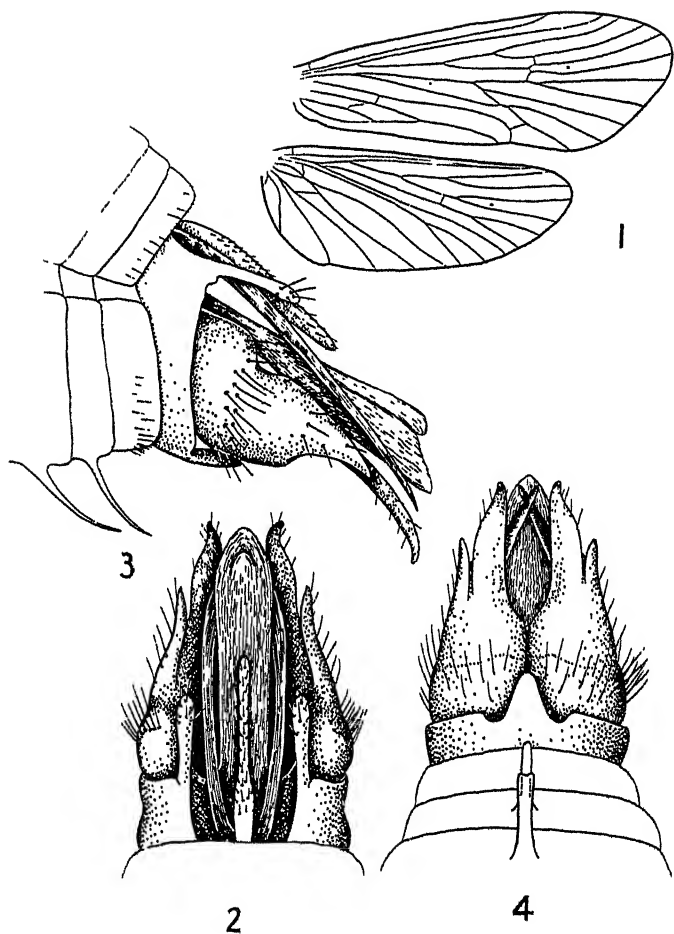
Genitalia ♂.—Margin of the 8th tergite straight, 9th withdrawn and produced at the centre of its apical margin in a long tapering process on each side of which is a superior appendage, rod-like and very slightly constricted before its apex; beneath is a pair of very long spines whose apices approach each other and cross; penis long and membranous, divided at the apex in an upper and lower part; inferior appendages with a branched distal portion welded to a stout base, the branches long and curving slightly downward, pressed close to each other, the inner the longer; arising at the centre of the margin of 9th sternite is a strong, triangular projection, the margin being excised at its base on each side; single, curving spines arise at the centre of the 6th and 7th sternites.

Length of the anterior wing, ♂ 6 mm.

Fiji: Viti Levu, Vunidawa, 31. iii. 1933; Waidgi, viii. 1927 (*H. W. S.*).

Type ♂ and paratype ♀ presented to the British Museum by the Imperial Institute of Entomology.

It is possible that this species may be synonymous with *Goera fijiana* Banks, of which no description or figures of genitalia have been given.



Goëra vuvula, sp. n., ♂.

- Fig. 1.—Wings.
 Fig. 2.—Genitalia, dorsal.
 Fig. 3.—Genitalia, lateral.
 Fig. 4.—Genitalia, ventral.

Leptoceridæ.

Triamodes fijiana, sp. n. (Figs. 5-8.)

Insect ochraceous in all parts.

Genitalia ♂.—Apical margin of the 9th tergite produced in a rather wide process set with widely spaced, short, fine hairs, with a rounded apex; from the angles of the dorsal margin of the tergite arises a pair of long spines with acute apices asymmetrically turned sharply at right-angles; superior appendages, lying on each side of the central process, are of about the same length; penis large and membranous, possibly asymmetric; inferior appendages bifurcate; from beneath, lower fork triangular, tapering towards the apex, upper surface set with short bristles; the second branch arises from the inner basal angle; it has a slender stem and dilated, flattened apex, and overlies the first branch; centre of the margin of the 9th sternite produced and excised.

Length of the anterior wing, ♂ 5 mm.

Fiji: Viti Levu, 2. viii. 1923 (*C. L. Edwards*).

Type ♂ in the British Museum (Natural History).

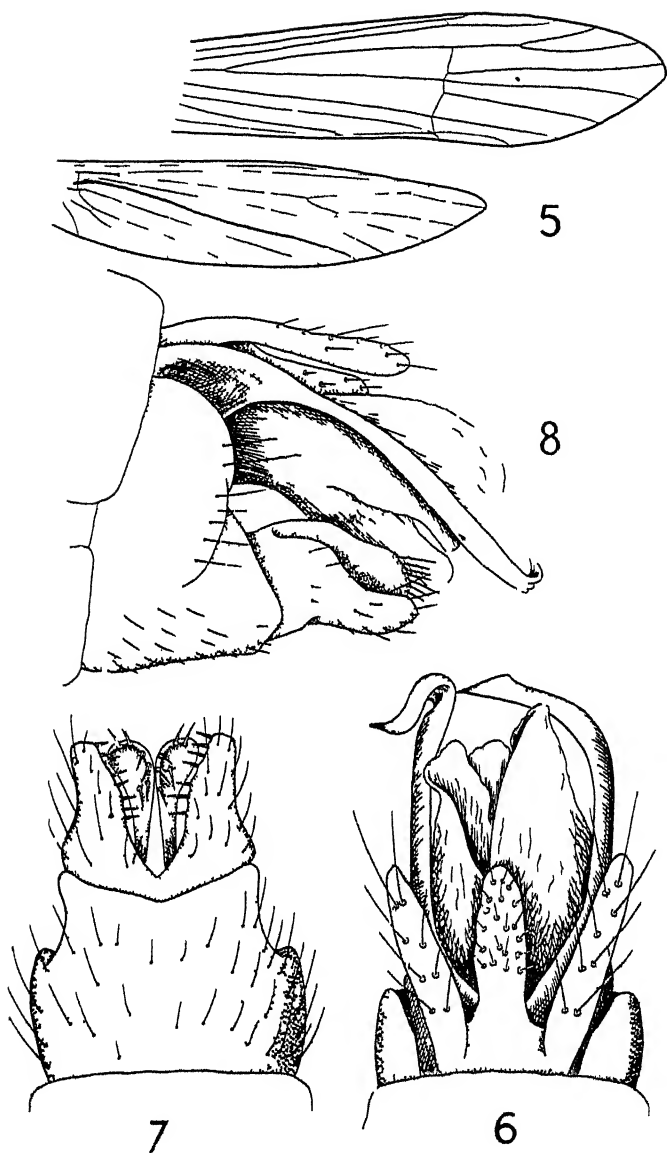
Hydropsychidæ.

ABACARIA, gen. nov.

In the known species in this genus, the wings are black with white markings, particularly in the anterior. In this wing, forks nos. 1, 2, 3, 4 and 5 present: no. 1 sessile or with a minute foot-stalk (*ruficeps*, ♂, Brauer), fork no. 2 extending well beyond the cross-vein, fork no. 3 with a foot-stalk, no. 4 sessile, extending beyond the cross-vein closing the median cell, fork no. 5 with a foot-stalk; discoidal cell in both wings rather broad; in the posterior wing, forks nos. 2, 3, 5 present. Maxillary palpi, 1st joint short, 2nd slightly longer, 3rd slightly longer still, 4th about the same length as the second, 5th as long or longer than the first four together. Spurs 2, 4, 4. *Genitalia* of the *Hydropsyche* pattern.

Genotype, *Hydropsychodes fijiana* Mosely.

This genus has been erected to take certain Fijian species incorrectly placed in *Hydropsychodes*, namely *fijiana* Mosely and *ruficeps* and *piceus*, placed originally by Brauer in *Hydromanicus*, but subsequently transferred by Ulmer to *Hydropsychodes*.



Trianodes pyramus sp. n., ♂

- Fig 5 —Wings
 Fig 6 —Genitalia, dorsal
 Fig 7 —9th sternite and inf app's
 Fig 8 —Genitalia lateral

Abacaria ruficeps Brauer. (Figs. 9-13.)

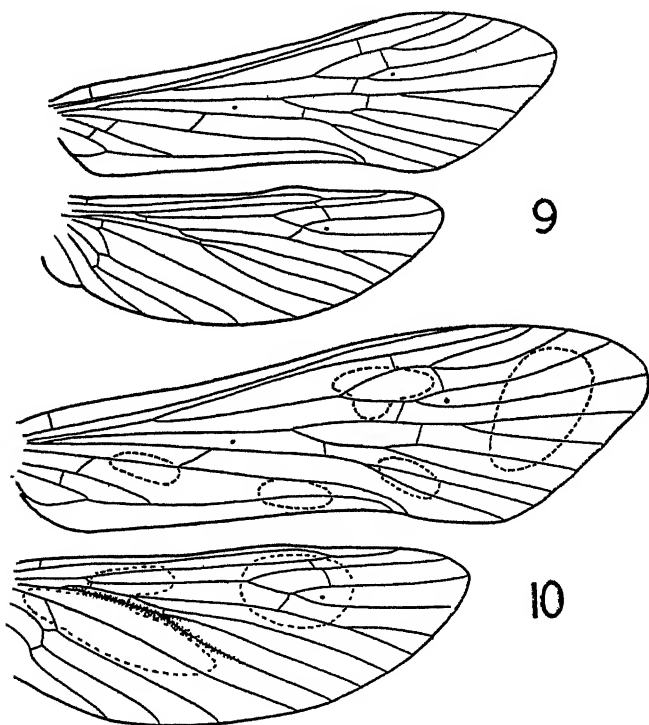
Hydromanicus ruficeps Brauer, Verh. Zool. Bot. Ges. Wien, xvii, p. 510, t. 14, fig. 2 a-b, 1867.

Hydropsychodes ruficeps Ulmer, Genera Insect., fasc. 60 a, p. 174, t. 38, fig. 5, 1907.

Hydropsychodes ruficeps Mosely, Eos, ix, p. 25, 1934.

Hydropsychodes ruficeps Banks, Psyche, xliii, p. 33, 1936.

This species differs from *A. fijiana* Mosely mainly in the nearly unicolorous wings of the male and the red clothing



Abacaria ruficeps Brauer.

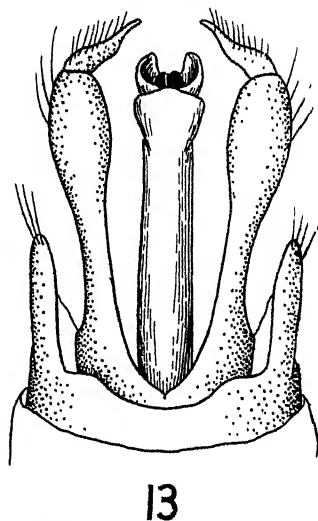
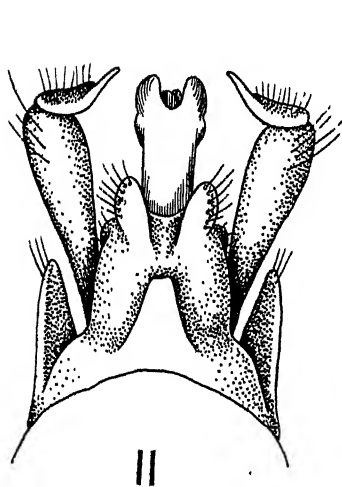
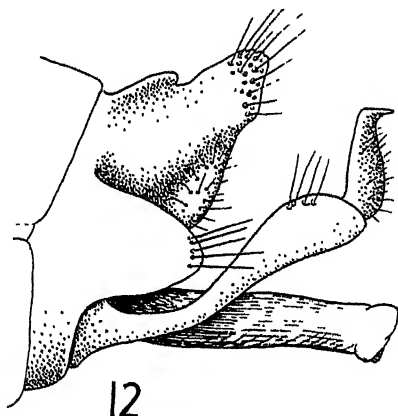
Fig. 9.—Wings, ♂.

Fig. 10.—Wings, ♀.

of the head. Figures are given of the neuration of both ♂ and ♀, indicating slight differences between the two sexes.

Genitalia ♂.—9th tergite produced at the centre of its apical margin in a cone-shaped process with a blunt and

slightly excised apex ; beneath this is a large plate, broad at its base, tapering to an excised apex ; from the side, directed slightly upwards with the lower margin dilated



Abacaria ruficeps, Brauer, ♂.

Fig. 11.—Genitalia, dorsal.

Fig. 12.—Genitalia, lateral.

Fig. 13.—9th sternite, inf. apps., penis, ventral.

and fringed ; side-pieces of the 9th segment much produced, apices rounded and bearing some stout hairs ; penis long and more or less straight, apex excised, with

a pair of nodules at the base of the excision; inferior appendages two-jointed, basal joint long, from the side with a dilated apex with oblique apical margin, from which arises a small second joint directed upward, with an extended and pointed apex.

Length of the anterior wing, ♂ 7 mm.; ♀ 8 mm.

A pair in the British Museum were taken *in coitu* on Viti Levu. Mt. Lautoka, 23. x. 1921 (*W. Greenwood*).

Abacaria picea Brauer.

Hydromanicus piceus Brauer, Verh. Zool. Bot. Ges. Wien, xvii. p. 512, t. 14, 1867.

Hydropsychodes picea Ulmer, Genera Insect., fasc. 60 a, p. 174, 1907.

Hydropsychodes picea Mosely, Eos, ix. p. 25, 1934.

Hydropsychodes piceus Banks, Psyche, xliii. p. 33, 1936.

I am not acquainted with this species but, judging from Brauer's description, accompanied only by a figure of the maxillary palpus, it belongs to the new genus.

Abacaria fijiana Mosely.

Hydropsychodes fijiana Mosely, Eos, ix. pp. 20-22, figs. 6-10, 1934.

Further material, all females, has been presented to the British Museum by the Imperial Institute of Entomology, collected by R. A. Lever, Viti Levu, R. Waidina, 6. vii. 1939, Ba, 1. iii. 1940.

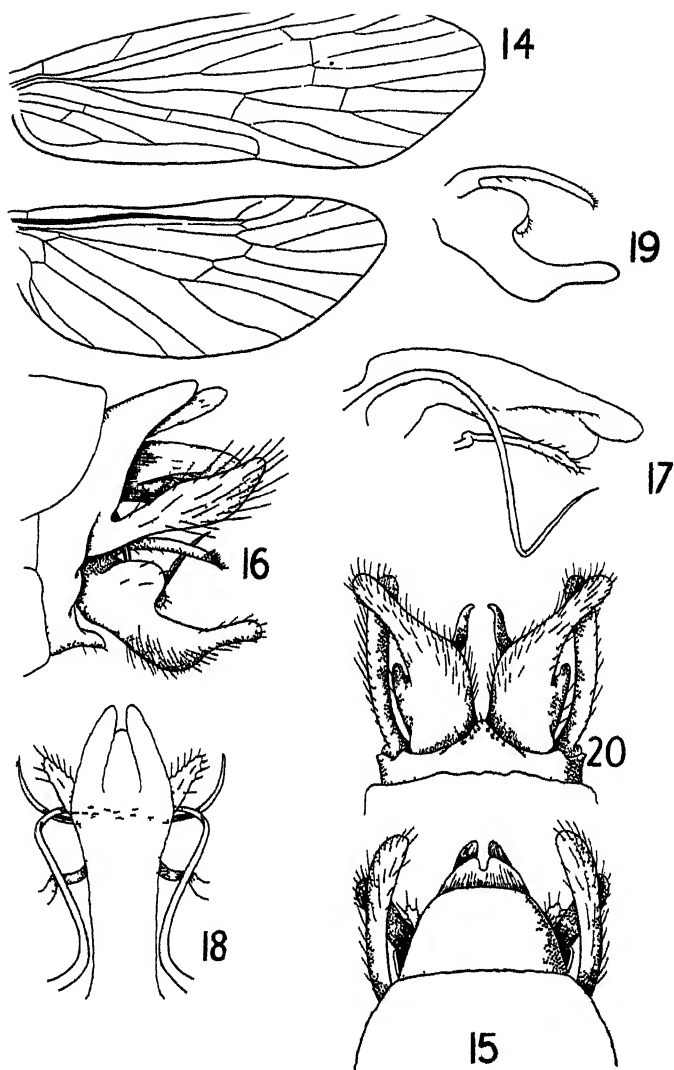
Polycentropidæ.

Polyplectropus greenwoodi, sp. n. (Figs. 14-20.)

Insect brownish with the usual irrorated, brownish-yellow wings customary in the genus. In the posterior wing fork no. 1 is present, which should place the species in *Polycentropus*. I am inclined to consider that this is aberrant or abnormal as there appear to be only four anal veins, and the first two costulæ are unconnected by a cross-vein, as is characteristic of *Polycentropus*.

It is possible that *Polycentropus* is entirely replaced by *Polyplectropus* in the Pacific.

Genitalia ♂.—9th tergite produced and membranous, apical margin truncate; beyond it is a membranous plate with excised apical margin; there is a pair of long, spiniform intermediate appendages twisting beneath the penis with the apices turned inwards at right-angles, overlapping each other; side-pieces of the 9th segment developed into long processes, dilated in the middle.



Polyplectropus greenwoodi, sp. n., ♂

- Fig 14 —Wings
 Fig 15 —Genitalia, dorsal
 Fig 16 —Genitalia, lateral
 Fig 17 —Penis, inf apps and lateral branches of the side-pieces, lateral
 Fig 18 —The same, dorsal
 Fig 19 —Inf app, lateral
 Fig 20 —9th sternite, inf apps and side-pieces of the tergite

narrowing to subacute apices; arising from the inner surface of the segment, opposite these side-pieces, is a pair of short, sinuous branches, apices dilated gradually, with serrate and fringed apical margins; penis large, membranous with a membranous, bifurcate upper penis-cover; no visible sheaths; no lower penis-cover; inferior appendages three-branched; from below, the lower branch is broad at its base, narrowing a little abruptly to a long, narrow apical part, directed outward, with a rounded apex; at the base, the outer margin is dilated or produced to form a rounded, upwardly-directed hook; from the side, this appears as a rounded dilatation of the upper margin at the base; the second branch, from the side, arises just above this dilatation and forms a strongly chitinized rod, directed tailward with a very acute apex; the third branch arises on the inner surface of the appendage at the base of the second branch and is short and curved with a dilated apex; 9th sternite produced at the centre of its margin in a broad triangle; the usual short lateral filaments to the 5th segment.

Length of the anterior wing, ♂ 8 mm.

Fiji: Viti Levu, Mt. Lautoka, 22. viii. 1920 (W. Greenwood).

Type ♂ presented to the British Museum by the Imperial Institute of Entomology.

Philopotamidæ.

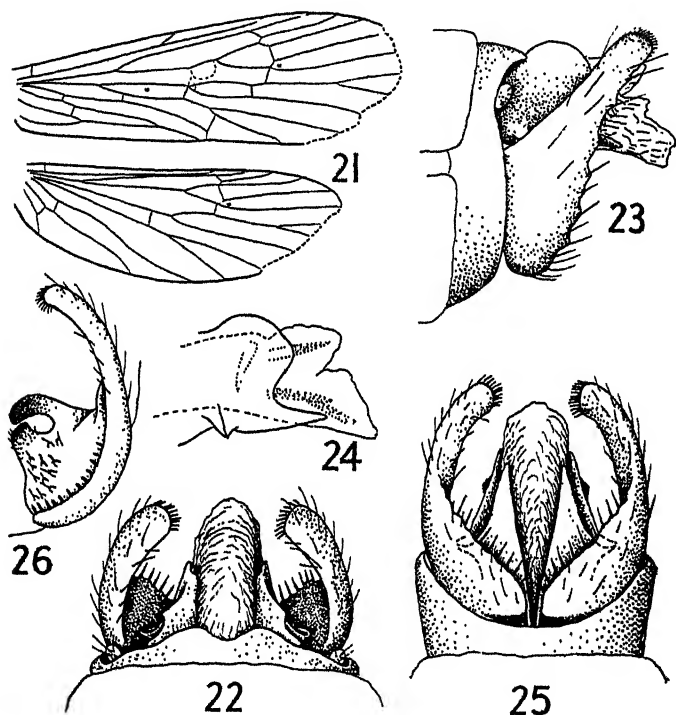
Chimarrha indigota, sp. n. (Figs. 21-26.)

Insect black; wings bluish black, iridescent; in the anterior, fork no. 1 extends slightly beyond the cross-vein closing the discoidal cell.

Genitalia ♂.—Apical margin of the 8th tergite straight, of the 9th, produced and excised; superior appendages minute and rounded; there appears to be an upper penis-cover, open or membranous above, more strongly chitinized at the sides; penis large, membranous, furnished with four strong, black spines, partly embedded in the membrane; lower penis-cover forming a pair of elongate, triangular plates with acute apices, joined about midway to the upper penis-cover by acute, lateral projections of the margin; inferior appendages caliper-shaped, apices rounded and set with evenly-spaced, short bristles.

bases broad and inner margins set with stout teeth; viewed from behind, the upper inner margin of the base is dilated and forms a pair of stout, hooked, blackish plates, the upper curving over the lower to enclose a circular space; no ventral process.

Length of the anterior wing, ♂ 6.5 mm.



Chimarra indigota, sp. n., ♂.

- Fig. 21. Wings.
 Fig. 22. Genitalia, dorsal.
 Fig. 23. Genitalia, lateral.
 Fig. 24. Penis, etc., lateral.
 Fig. 25. Genitalia, from beneath and slightly from behind.
 Fig. 26. Inf. app., from behind.

Fiji: Taveuni, xii. 1928 (*H. W. S.*); Ovalau, v. 1912 (*H. W. Simmonds*); Ovalau, v. 1926 (*H. W. S.*); Savu Savu, iii. 1922 (*H. W. S.*).

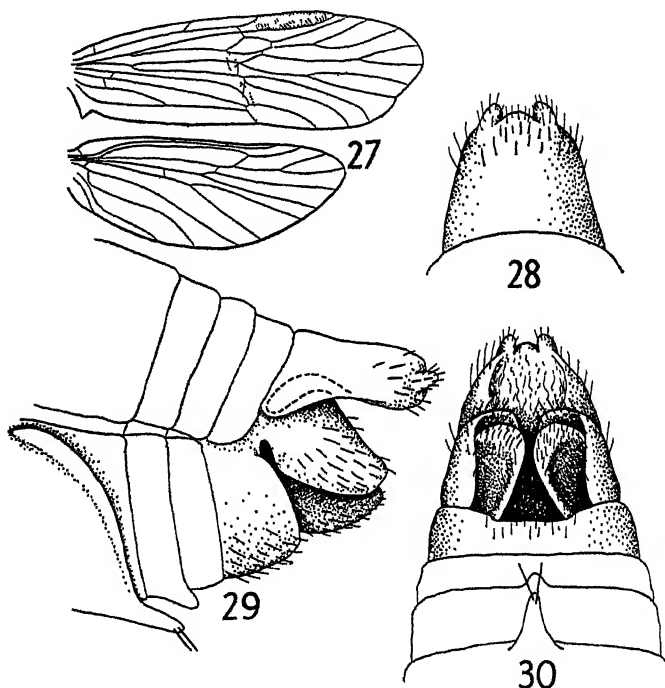
Type ♂ (Taveuni) and paratypes ♂ (Ovalau) in the British Museum.

This may possibly be a synonym of Bank's *Chimarrha manni*.

Rhyacophilidæ.

ACHOREMA, gen. nov.

The genus is represented by a single species in the female sex. It is allied to the *Psilochorema* group, containing insects with brownish wings mottled with yellow.



Achorema banksi, sp. n., ♀.

Fig. 27.—Wings.

Fig. 28.—Apex of abdomen, from above.

Fig. 29.—The same, lateral.

Fig. 30.—The same, from beneath.

In *Achorema* the anterior wings are rather long, apical portion only slightly dilated, pterostigma very distinct, forks nos. 2, 3, 4 and 5 present, nos. 2, 3 and 4 with foot-stalks, 5 sessile; discoidal cell short and broad,

upper margin strongly angulated; posterior wing with only forks nos. 2 and 5 present, both with foot-stalks, discoidal cell wanting. Maxillary palpi with the 1st and 2nd joints short, 3rd nearly as long as the first two, 4th slightly shorter than the 3rd, 5th about as long as the 3rd. Spurs 2, 4, 4; processes to the 5th and 6th sternites, that of the 5th being a continuation of a lateral ridge.

Genotype, *Achorema banksi*, sp. n.

Achorema banksi, sp. n. (Figs. 27-30.)

Insect brownish. Anterior wings brown with yellowish patches covered with soft yellow hair, coloration extending into the membrane of the wing; posterior wing brownish, deeper in colour towards the apex; neurulation as figured: antennæ brown, basal joint rather large; head light yellow: legs darker yellow, spurs brown.

Genitalia ♀.—Terminal segment produced, with two minute processes towards the apical margin; from beneath, there are two large valves each bearing an inner valve; 6th sternite with a small rounded and 5th with a long, pointed process which is a continuation of a pair of strong, lateral ridges.

Length of the anterior wing, ♀ 6 mm.

Viti Levu, R. Waidina, 6. vii. 1939 (*R. A. Lever*), 3 ♀♀.

Type, mounted in balsam, and paratypes presented to the British Museum by the Imperial Institute of Entomology.

I have pleasure in dedicating this species to Mr. Nathan Banks, who has done much to further the knowledge of the Trichoptera of Fiji.

List of Described Fijian Trichoptera.

SERICOSTOMATIDÆ.

<i>Goëra fijiana</i> Banks	Viti Levu.
<i>Goëra munita</i> , sp. n.	Viti Levu.

CALAMOPTERIDÆ.

<i>Anisocentropus fijianus</i> Banks'	Vanua Levu.
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LEPTOCERIDÆ.

<i>Tripletides pallida</i> Banks	Viti Levu.
<i>Trienodes manni</i> Banks	Viti Levu.
<i>Trienodes dubia</i> Mosely	Viti Levu.
<i>Trienodes fijiana</i> , sp. n.	Viti Levu.
<i>Ecetinaella pulchella</i> Banks	Viti Levu.

HYDROPSYCHIDÆ.

<i>Abacaria (Hydropsychodes) ruficeps</i> Brauer	Ovalau.
<i>Abacaria (Hydropsychodes) picea</i> Brauer	Ovalau.
<i>Abacaria (Hydropsychodes) fijiana</i> Mosely	Viti Levu.

POLYCENTROPIDÆ.

<i>Polyplectropus manni</i> Banks	Taveuni.
<i>Polyplectropus fijianus</i> Banks	Taveuni.
<i>Polyplectropus greenwoodi</i> , sp. n.	Viti Levu.

PHILOPOTAMIDÆ.

<i>Wormaldia nervosa</i> Brauer	Ovalau.
<i>Chimarra manni</i> Banks	Taveuni.
<i>Chimarra obscurella</i> Banks	Taveuni.
<i>Chimarra signata</i> Banks	Taveuni.
<i>Chimarra indigota</i> , sp. n.	Taveuni; Ovalau; Savu Savu.

REYACOPHILIDÆ.

<i>Achorema banksi</i> , gen. nov., sp. n.	Viti Levu.
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- BANKS. "Trichoptera from Fiji Islands." 'Psyche,' xliii. pp. 29-35, pl. ii. figs. 1-11, 1936.

XXIII.—*A new Zeomorph Fish from the Paleocene Moler of Denmark.* By W. G. KÜHNE, Leighton, near Frome, Somerset.

INTRODUCTION.

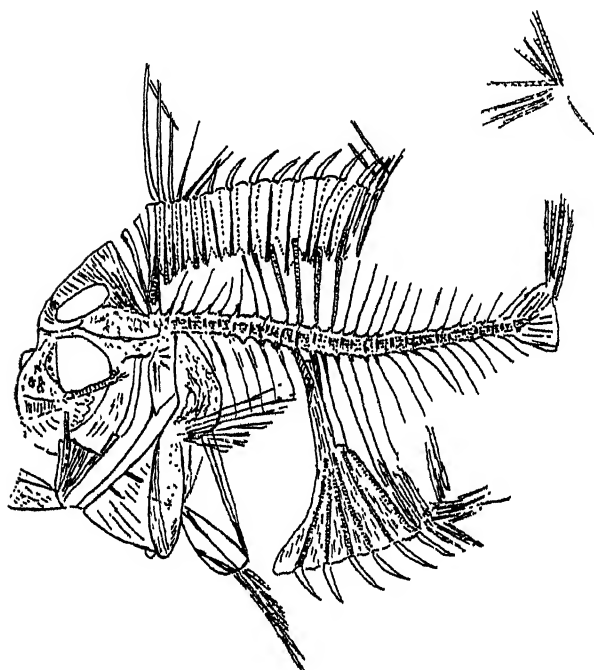
This unique specimen, which I have named *Palæocentrotus böggildi**, gen. et sp. n., was found by my wife during excavations in 1937 in the pit of the Skarrehage-Molerværks, Isle of Mors, Jutland.

The specimen, together with a collection of other fossils from the Moler, was purchased by the British Museum and bears the number P.22956-7. It is the first teleost from the Moler to be described in detail. The stratigraphical level of the fossil is about 2 m. below the layer of volcanic ash, ("minus 18a,") of Böggild; that is, near the base of the Moler. The Moler is a diatom-deposit

* Named in honour of Prof. O. B. Bøggild, in recognition of his work on the intercalated layers of volcanic ash and the stratigraphy of the Moler.

with a considerable component of clay, and splits perfectly, at least in the layers from which the fishes were excavated. The preservation of the fishes is extremely good, showing even the minutest details of the sculpture of bones. All Moler fossils, except those from the so-called cement-stone, are impressions only; but that fact is of advantage with regard to the fishes, for if the original calcareous

Fig 1.



Palæocentrotus böygildi, gen. et sp. nov.

Drawing of the right side of the fossil, partly restored
from the left side. [$\times 9/10$.]

substance is preserved and the fossil is exposed by splitting, the broken bones are identical, part and counterpart, whereas the Moler fishes, on the contrary, show the left and the right surfaces seen from inside.

Part and counterpart of the fossil are present. The anterior part of the skull, with maxilla, premaxilla, and

dentary, was broken off before the fossil was found, while decay of the skin has resulted in the complete loss of the scales, and the soft parts of the dorsal and anal fin as well as part of the caudal fin are missing.

The fish seems to have touched the soft seabed with its right side, then to have drifted a few metres, lengthwise, and settled down. This is shown in the right pectoral, which was pressed together and bent downwards when passing over the ground, as well as by the anterior spines of the dorsal fin, which broke when they stuck in the mud, owing to the pressure of the current on the body. Part of the caudal, which became loose before embedding, was driven in the same direction and lies some few cm. above. These caudal rays, which are still connected to the hypural, were turned upwards 90° from their natural position. The deposition of mud must have been rapid, thus preventing any further decay or loss. After entombment the fish was much compressed, so that paired bones are often in contact. The left side, which was uppermost, was more affected than the right (a feature often seen in ammonites) and this is to be seen more particularly with the operculum and clavicle.

DESCRIPTION.

In shape the fish is strongly compressed. From the point of the occipital crest to distal end of postclavicle it measures 55 mm.; from the centre of the orbit to end of the hypural, 71 mm. (this distance is referred to below as "the length"). The highest point of the body is above the first caudal vertebra, and the lowest point at the base of the first anal spine. The line connecting both points measures 61 mm. and makes with the "length"-line an angle of about 95° .

This angle is similar in *Zeus* and *Zenopsis* but is not regarded as a typical one among the *Zeomorphi*; it may result from a certain degree of body-shortening.

The head and pectoral arch form one-third of the length. The abdominal cavity is deep and short, measuring one-fourth of the length, while the base of pectoral lies just in the lower half of the body.

VERTEBRAL COLUMN.

There are 10 abdominal, 16 caudal vertebræ, and a hypural. The vertebral column cuts the "length"-line at the last abdominal vertebra. Measured on this line its highest point is at the last abdominal vertebra and its lowest at the sixth caudal vertebra. The first two centra are hidden by bones of the pectoral girdle; their neural spines are vertical. The neural spines of the following six abdominal vertebræ are bent backwards at an angle of 55° . The spine of the last abdominal vertebra, as well as the spines of the two anterior caudals, are bent slightly forwards. The neural spine of the third caudal vertebra is vertical, the spines of the others being bent backwards. The four posterior abdominal vertebræ have short and strong parapophyses, those of the two anterior caudal vertebræ are strong and long, partly clasping the first radial of the anal. The neural spines of the four anterior caudal vertebræ are flattened longitudinally at the top and inserted between the radials of the dorsal. All the other spines are much stronger transversely than longitudinally, producing deep furrows in the fossil.

The centra of vertebræ are almost cylindrical, not hour-glass shaped. Between thin ridges of bone are spacious oval impressions which are sub-divided by similar but vertical ridges. Vertebræ nos. 6-10 and 22-26 are almost square in longitudinal section, the remaining ones being more compressed. The diameter of the centra decreases slightly from the 20th vertebra backwards.

Before making a comparison with the vertebral column of *Zeus*, it is necessary to make clear its function in that genus. The protraction of the jaw-apparatus of *Zeus* is accompanied by a sudden lifting of the head, which is therefore movable upwards. The differentiations of the vertebral column of *Zeus* all serve to permit that movement, by giving the five anterior vertebræ the utmost movability except the first, which is fixed to the basioccipital, while the remaining ones are stiffened as much as possible.

In transverse section the centra of vertebræ

nos. 2-7 are O-shaped, thus rendering vertical movement easy; the second and third vertebrae are relatively shorter than those following, so that the vertebral column has relatively more joints in front than elsewhere. The centra of vertebrae behind the seventh are in transverse section O-shaped, which restricts vertical movement. The zygapophyses of the second to fifth vertebrae allow bending, but the upper zygapophyses and the parapophyses of the following vertebrae, which are ankylosed into hæmal arches, render every vertical movement of the posterior abdominal vertebrae impossible.

The typical inclination of the neural spines of the anterior abdominal vertebrae backwards, and that of the posterior abdominal vertebrae forwards, serves the same purpose. The anterior neural spines are movable between the radials of the dorsal fin, whereas the posterior spines are immovable, and the strong muscle, which elevates the head, is partly fixed on them.

The S-shaped vertebral column occasions the enlargement of the ventral part of the body at the expense of the dorsal: the abdominal cavity becomes deepened, and the visceral skeleton (proximal end of hyomandibular) is attached higher to the skull.

In this fish the inclination of the neural spines as well as the S-shaped bending of the vertebral column are the same as in *Zeus*, but the double stiffening of the posterior abdominal vertebrae had not yet been developed,

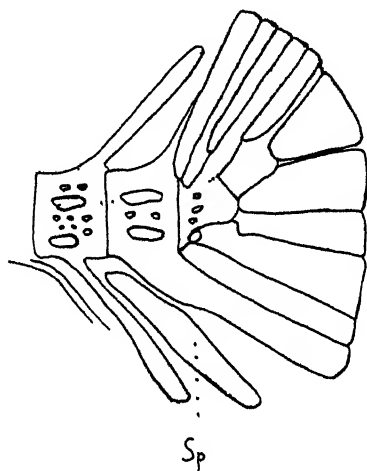
so that in protruding its mouth, such a strong upward movement of its head as in *Zeus* was not possible.

Regan gives a drawing of the hypural of *Polymixia nobilis* which is in principle not unlike the hypural of *Palæocentrotus*. The differences are: in *Polymixia*, between the uroneural and the hæmal spine of the main centrum of the hypural there are 7 hypural bonelets instead of 5.

Polymixia has 3 epurals, *Palæocentrotus* at least 4. In *Polymixia* the median hypural bonelet has a serration;

in our specimen the posterior margin of the hypural is straight. A hypural spine is present in both genera : in the fossil the impression of it runs underneath the first

Fig. 2.



Hypural and last caudal vertebra of
Palaeocentrotus hoggildi, gen. et sp. nov., enlarged.

centrum of the hypural, which is covering it. The ribs are thin and very short, reaching a little below the upper third of the abdominal cavity.

FINS.

In front of the fin there are two free radials. The first is in contact with the first neural spine, the second is fixed to the first radial of the dorsal, which is broadened longitudinally on its lower end.

The anterior part of the dorsal consists of six long, slender spines ; their radialia are pressed distally together, slightly diverging proximally. All spines are furrowed. The first spine is the longest and is almost complete, measuring two-fifths of the body-height. The sixth is the shortest, about as long as the diameter of the orbit.

The points of the three anterior spines are broken, as already stated above, by the fish coming into contact with the sea-bottom before

being covered. One may therefore assume that the anterior spines of the dorsal were erected, and remained so after death; otherwise there is no reason why the spines, when touching the ground, should not have been bent backwards.

The middle part of the dorsal fin comprises eight strong, short, spines slightly bent backwards, each of them having on both sides a shallow furrow. The height increases from the first to the fifth spine; behind the fifth one, the spines are of similar height, about two-thirds the diameter of the orbit. The radials of the spines are strong and broad, distally strengthened and with strong transverse blades. The radials of the five posterior spines are inserted between the neural spines.

The posterior part consists of only two rays and two feeble radialia *in situ*.

The anterior part of the anal comprises six spines similar in form and length to the corresponding spines of the dorsal. The radials occupy the space between the first and third hæmal spines. The first anal spine is short and straight; the others slightly longer and curved backwards. The proximal part of the first radials is a strong round bone; the lower end of it is strongly inclined forwards.

Six radials and broken parts of some rays are still preserved of the soft posterior part of the anal. These radials are more feeble than those of the spines. The transverse blades of the radials of the rays are feeble and their distal ends are simple.

In *Zeus* the radials of the rays of dorsal and anal fins serve as bases for the spiny plates on both sides of the vertical fins. The transverse blades of each radial are provided on their distal ends with two protruding and broadened facets, one above the other. On these the spiny plates are fixed. The transverse section of the radials of the rays in *Zeus* is +-shaped, but +shaped in the new fish. This difference shows the absence of spiny plates in *Palæo-centrotus*.

The radials of the rays are not strongly connected, as are those of the spines, and this leads

to the partial loss of the soft part of the vertical fins, while the spinous part is completely preserved.

The Pectoral has at least 13 feeble rays, their distal half being divided. The upper rays, being the longest, almost touch the first radials of the anal.

The Pelvic fin has few rays, lying close together, and all are broken. The first is longer and stronger than the others; it may be a spine, as the two fins lie one on another; the number of rays unfortunately cannot be counted.

Of the caudal, five rays are still *in situ*; five others have been torn from the hypural and are embedded a few cm. above. They are of the same size, so that

the caudal seems to be truncated and not deeply forked.

PECTORAL ARCH.

The clavicle is vertical. The blade covering the gill-cavity was badly crushed during fossilization. The longitudinal blade is well preserved. From the middle downwards, beginning at the anterior and posterior margins, the bone is furrowed. The furrows coming from the anterior margin reach to the lower posterior end of the bone, cutting off those from the posterior margin. The distal end of the postclavicle almost reaches the lower margin of the body, behind the basipterygium.

BASIPTERYGIUM.

This bone has no special features. From the fin-base to the upper end of the bone runs a ridge, not much elevated, but divided in its upper third. Another ridge starts from the same spot as the first, ending at the middle of the anterior margin of the bone.

CRANIUM.

The bones of the cranial capsule cannot be isolated: the form is short and high. The very high occipital crest of *Palæocentrotus* is one of its salient features. Posteriorly it has a thin, narrow blade. Its base is broad and massive; its upper anterior part runs forwards, without connection with the parietals, to meet the frontal crest in a distinct suture. Thus between the parietals, the occipital crest, and the frontal crest, which is bent

backwards and upwards, is a spacious hole. The frontal crest is anteriorly slightly thickened and is there finely granulated. The parasphenoid is very primitive, the anterior part is long and slender, while the posterior end is curved upwards and is sculptured. The orbit is of normal size.

Fig. 3.



Anterior part of *Palæocentrotus boggildæ*, gen. et sp. nov.
(about nat. size)

VISCERAL SKELETON.

The operculum very small and slender; on the left side of the fossil, its lower point is visible on a level with the base of the pectoral. From the joint with the squamosal some ridges diverge downwards and backwards. The interoperculum is an unsculptured, slender bone. The preoperculum is slightly nicked in the middle, its upper and lower part making an angle of about 130° . The hyomandibula and symplectic run parallel with the operculars. The quadrate is slender, the upper and lower margins diverging at 35° ; and it bears strong longitudinal sculpture. From the lower jaw only the posterior part of the angular is preserved.

The form of the lower jaw, as well as the strong ethmoids, indicates a strong and effective biting-apparatus. The very deep joint of the lower jaw

indicates a long mouth, slanting upwards. The jaw apparatus of *P.b.* was not so extraordinarily protractile as in *Zeus*.

Two slender and oblong suborbitals are *in situ* on the left half; two others are dislocated and lie embedded on the left side of the occipital crest. On the left side of the fossil six branchiostegals are present, with three on the right side, their points showing from under the interoperculum and lying on the large urohyal. On the left side of the fossil the lower point of the urohyal is hidden by the clavicle, but on the right side it is visible, the furrowing, which is distinct all over this very big bone, being especially pronounced here.

DISCUSSION AND SYSTEMATIC POSITION.

There is no doubt that *Palæocentrotus böggildi* should be included in the order Zeomorphi; a comparison with *Zeus* and *Cyttus* yields sufficient evidence. Conclusions resulting from a comparison with the vertebral column of *Zeus* have been already discussed above. The ossification of the centra is very similar both in this fish and in *Zeus*. The short and slender ribs are a primitive feature in general; it is found among all Berycidae and Zeidae. The hypural is essentially berycomorph; and the visceral skeleton in general resembles that of the Zeidae, and so does the small operculum and the elongated, narrow and smooth preoperculum. The slender quadrate, the jaw-attachment, and all proportions are essentially zeomorph, but to *Grammicolepis* there is no relation.

The preoperculum of the Berycidae is either serrated or denticulated, the nick lies in the lower third, not in the middle of the bone, as it does in the Zeidae. The position of the preoperculum is vertical or inclined slightly backwards, while in the Zeidae it is directed forwards.

The primitive parasphenoid is a feature of all Berycomorphi and Percomorphi, and its form is not advanced in all Zeomorphs. The pectoral girdle of *Palæocentrotus* is not distinctive; it resembles in general that of the Ephippidae, but there is a striking similarity in the sculpture of the clavicle to that of *Cyttus*. *Palæocentrotus* has six anal spines; the Zeomorph with the most is *Zeus*,

with four spines, being the only recent shallow-water Zeid. But the Berycid *Dinopteryx* from the English Chalk has even seven anal spines. The number of vertebrae, 27, is smaller than in all other Zeidæ and Grammicolepidæ, and greater than in *Antigonidæ*, and matches that of the Berycidæ, which have 24-30. The basipterygium is more primitive than in either the recent Zeidæ and Berycidæ.

The features mentioned above are zeomorph, berycomorph or of either group, but its occipital crest does not fit in at all. It is the reason which prevents me from connecting directly the Berycidæ and Zeidæ by means of *Palæocentrotus*. The only crest comparable with it is that of the recent genus *Kurtus*.

In *Kurtus* the occipital crest is shaped like a hook directed forwards. It stands without connection above the parietals, while the small frontal crest does not reach its point.

The resemblance is very far-reaching. The parts of the crest which are present in *Palæocentrotus* are to be found in the same position in *Kurtus*. Both the hook in *Kurtus* and the hole in *Palæocentrotus* are the result of resorption of bone; this causes the radial sculpture of the crests, which converges on the centre of ossification of the supraoccipital. This resemblance is mentioned here because *Kurtus*, like the fossil, is also closely related to the Berycidæ in other features. Thus the very strange crest is common to two genera, both representing an early stage in the higher development of the Acanthopterygii.

It should be said, finally, that while the number of vertebrae, the hypural, and the number and form of fin-spines in *Palæocentrotus* are primitive, the cranium and visceral skeleton are advanced.

One may conclude from this that while protection and locomotion are still of the same kind as in the Berycidæ, the feeding of the new form was already quite different from that of its Berycomorph ancestors.

The vertebral column is already partly adapted to the new kind of feeding. The neural spines of the abdominal vertebræ are for lifting the head: the S-shaped vertebral column produces an enlargement of the abdominal cavity, capable of taking larger prey, and the elevation of the head gives more space for the visceral skeleton

To include *Palæocentrotus* in an existing family is not possible, but a complete diagnosis of the new family Palæocentrotidæ, cannot be established only on this incomplete fossil. I give the following notes in the hope that they may be added to, should better specimens be found later:

Number of vertebræ smaller than among Zeidæ.

Vertebral column S-shaped.

Hypural berycomorph.

Parapophyses not co-ossified as in *Zeus*.

Spinous anal having more elements than any recent Zeomorph.

Visceral skeleton zeomorph.

In determining the systematic position of this fish one may say that it is a non-primitive representative of a side-branch, derived from the still hypothetical line Berycidæ-to-Zeomorphs at about the time when the Antigonidæ were first present as an independent family. It is much more closely related to the Zeidæ than to the Berycidæ.

The hypural spine, being in contradiction to the diagnosis of the division Zeorhombi of Boulenger, does not prevent me from including this fish in the order Zeomorphi.

In his work on the classification of the Zeomorphs, Regan points out the close relationship of that order to the Berycomorphi. The new find supports that view.

The find of *Palæocentrotus* makes it likely that the fish-fauna of the upper-paleocene Moler were much more primitive than the younger one from the Lutetien of Monte Bolca. The development of the teleosts seems to be much less advanced than in the Middle Eocene.

Director A. Gram and Engineer H. D. Spangsberg from the Skarrebage-Molerværks kindly rendered every possible aid during our excavation in Skarrebage. Dr. E. I. White

of the British Museum (Nat. Hist.) was kind enough to send the specimen for examination to Berlin in 1938. Professor Pappenheim and Dr. Ahl. from the Naturkunde-Museum at Berlin, gave me friendly advice. I received also the most valuable help from Mr. J. R. Norman and Dr. C. Tate Regan, F.R.S., of the British Museum (Nat. Hist.). To all of them my hearty thanks.

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XXIV.—On *Upper Tournaisian Goniatites* from New South Wales, Australia. By G. DELÉPINE.

[Plate V.]

INTRODUCTION.

Goniatites have recently been found in the Carboniferous formation of the Werrie Basin, Babbinsboon district. New South Wales. S. W. Carey, describing the Merlewood section, where the *goniatites* were discovered, gives the following account of the sequence:—Resting on the Barraba Series, part of which is made of volcanic tuffs and breccies, the Carboniferous formation begins with a basal conglomerate, and includes from bottom to top the Burindi, the Lower Kuttung, and the Upper Kuttung Series.

The Burindi Series, in the Merlewood section, has yielded marine fossils at two different horizons. The first, about 400 feet above the basal conglomerate,

yielded a few corals. Zaphrentids are rare, but *Cladonchonus tenuicollis* McCoy is fairly abundant. The second horizon, 200 feet higher, contains numerous brachiopods, lamellibranchs, and also some goniatites. In the list of fossils given by Miss Ida Brown the goniatites are recorded as follows :—

Protocanites cf. *lyoni* Meek & Worthen.

Glyphioceras (*Beurichoceras*) (?).

Goniatite (?).

At another locality (near Currabubula), at a high level in the Lower Burindi Series, a third fossiliferous bed with mainly brachiopods has been discovered.

Near the top of the Kuttung Series, in the Merlewood section again, another fossiliferous horizon contains numerous corals (*Amygdalophyllum*, *Lithostrotion*, etc.) and also brachiopods.

Miss Ida Brown kindly sent me the seven specimens of goniatites which have been found in the second horizon of the Burindi Series. They are internal casts, and fortunately the suture-lines are sufficiently well preserved for determination. There are five species, which will be described and figured in this paper, as follows :—

Protocanites lyoni (Meek & Worthen) (3 specimens).

Protocanites australis, sp. n. (1 specimen).

Imitoceras aff. *rotatorium* (de Koninck) (1 specimen).

Munsteroceras sp. (ex gr. *M. oweni* Hall) (1 specimen).

Nautellipsites (?) sp. (1 specimen).

I am indebted to Miss Brown for the loan of the specimens. I also express my thanks to Dr. L. F. Spath, of the British Museum (Natural History), for kindly helping me with the translation.

DESCRIPTION OF THE SPECIES.

Protocanites lyoni (Meek & Worthen).

(Pl. V. figs. 1, 2, 3.)

1860. *Goniates lyoni* Meek & Worthen, Proc. Acad. Nat. Hist. Philadelphia, p. 471.

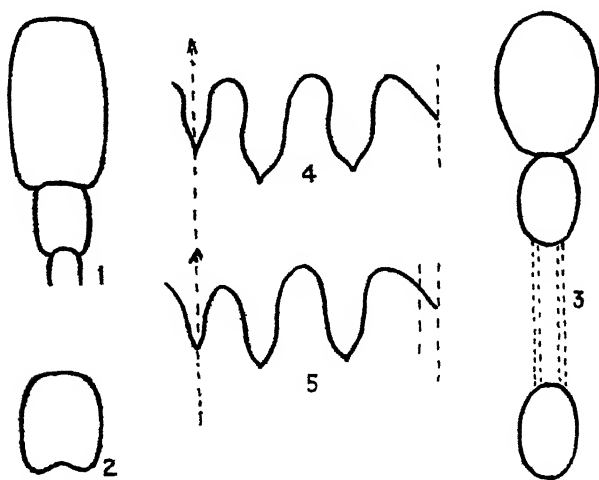
1866. *Goniatites lyoni* Meek & Worthen, Geol. Survey Illinois, vol. ii. p. 165, pl. xiv. fig. 11

1880. *Goniatites clymeniaformis* de Koninck, Ann. Musée Hist. Nat. de Belgique, p. 95, pl. xlix. figs. 12–13.

The three specimens from the Merlewood section have the typical suture-line of the genus *Protocanites* H. Schmidt.

There are two lateral lobes, pointing backwards, and the ventral lobe is V-shaped. The general form is serpentine: the whorls are compressed, flattened laterally; the venter is broadly rounded in the young whorls, but is more flattened in the adult.

In this species the shell quickly increases in whorl-height on the outer whorls, which become compressed, so that the sides and the venter are more flattened than in the young. This character is well seen in the two specimens of *Protocanites* "*clymeniaëformis*," figured



Text-fig. 1.—*Protocanites lyoni* (Meek & Worthen). Outline-section of whorls of specimen I.

Text-fig. 2.—*Protocanites lyoni* (M. & W.). Outline-section of the fragmentary specimen (Pl. V. fig. 2).

Text-fig. 3.—*Protocanites australis*, sp. n. Transverse section of the last whorls.

Text-fig. 4.—Suture-line of *Protocanites australis*, sp. n.

Text-fig. 5.—Suture-line of *Protocanites lyoni* (M. & W.).

by de Koninck. That author's fig. 12 shows a transverse section like that of our specimen (Pl. V. fig. 2, and text-fig. 2), but the stouter specimen of the same author's fig. 13 has a higher and proportionately narrower section, as in our specimen, Pl. V. fig. 1, and text-fig. 1. Hence there is a slight difference compared with the restoration of *Protocanites lyoni* (M. & W.) published by A. K. Miller

(1936, fig. 1), where the sides and the venter look more rounded. The latter figure shows that Meek & Worthen's type-specimen has the shape and dimensions of the first specimen (fig. 12) of de Koninck. On the whole, the specimens from the Merlewood section agree well with the Tournai specimens of *Protocanites clymeniaëformis* (de Koninck); but as the name given by Meek & Worthen has priority, they are included in *Protocanites lyoni* (M. & W.).

Dimensions of the Merlewood specimens *.

	D.	H.	W.	U.
Pl. VI. fig. 1	65 (?)	20	10	30 (?)
Pl. VI. fig. 2	—	15	11	—
Pl. VI. fig. 3	18	5.2	4	8.75

Protocanites lyoni M. & W. (= *P. clymeniaëformis* de Koninck sp.) differs from *Protocanites algarbiensis* Pruvost. The latter has a larger number of whorls and a wider umbilicus; the section of the whorls does not become so high, as the shell increases in size; also, the ventral lobe is not V-shaped, but a little deeper and slightly wider about the middle.

Stratigraphical range.—*Protocanites lyoni* is known from the Tournaisian of N. America as well as from N.W. Europe. At Tournai the examples of *Protocanites clymeniaëformis* described by de Koninck were found in the Calcaire de Vaulx, of Upper Tournaisian age.

Protocanites australis, sp. n.

(Pl. V. figs. 4-6; text-figs. 3, 4.)

Only one specimen of this species has been found. an internal mould showing the last whorl and the suture-lines. The diameter is 60 mm., the width of the umbilicus is 34 mm. The shell increased slowly in the earlier stages, but the last whorl is comparatively much wider. The height near the last suture-line is 11.5 mm.; it becomes 16 mm. at the end of the last whorl and the width

* D=Diameter; H=Height of the last whorl; W=Maximum width; U=Umbilicus; (?) means approximately.

increases from 8 mm. to 13 mm. These differences may be seen in the photograph here given of this specimen (Pl. V. fig. 4).

The whorl section is oval: the sides are regularly rounded from the venter to the umbilicus; the maximum width is near the middle (see text-fig. 3). The suture-line shows a deep ventral lobe, pointed backwards, with the sides not entirely parallel but slightly convex in the middle. The two lateral lobes are large, asymmetrically tongue-shaped and pointed backwards; the lateral saddles are rounded forwards. The dorsal part of the suture-line cannot be seen.

This species differs from *Protocanites algarbiensis* Pruvost by the oval (instead of angular) section of the whorls. The sides are also markedly more rounded than in *Protocanites lyoni* (M. & W.) and there are differences in the suture-line. The ventral lobe is V-shaped in *Prot. lyoni*; it is deeper in *Prot. australis* and somewhat convex in the centre; the lateral lobes in the latter species (as in *Prot. algarbiensis*) are wider and more asymmetrical than in *Prot. lyoni*.

I consider the specimen here described to show characters different from those of any other known *Protocanites*, and I make it the type of a new species, naming it after the country where it has been found.

Imitoceras aff. *rotatorium* (de Koninck).

(Pl. V. figs. 7, 8.)

1844. *Ammonites rotatorius* de Koninck, 'Description des animaux fossiles du Carbon. de Belgique,' p. 565, pl. li. fig. 1.

1898. *Agonides rotatorius* Haug, 'Études sur les Goniatites,' p. 39, fig. 9 e.

1903. *Agonides rotatorius* P. Smith, p. 112, pl. xix. figs. 13, 14.

There is one young specimen referable to the genus *Imitoceras* *: its dimensions are

D.	H.	W.	U.
32	19	17	0

* Schindewolf (1924, p. 325) proposed the name *Imitoceras* to replace *Agonides* Montfort, whose type is lost and might have been any Dinantian or even Namurian goniatite collected from somewhere in the Namur area.

This specimen is very close to de Koninck's *Imitoceras rotatorium* (= *ixion* Hall) in the involute shape, with closed umbilicus, and in the number and elements of the suture-line. It is more globular, however, than any figured specimen of that species. This may be explained by the fact that the Merlewood specimen is immature: on further growth the general form would probably have become more compressed, the lateral sides more flattened, and the oral aperture higher. De Koninck's type-specimens of *I. rotatorium* in the Natural History Museum of Brussels have nearly the same globular shape in the early stages of growth as the Australian form.

Although I do not definitely identify the Australian specimen with *Imitoceras rotatorium* (de Kon.), I do not think that it is a new species; it is probably a form within the limits of variation of the typical *Imitoceras rotatorium* (de Kon.), exactly like the American *Imitoceras ixion* Hall sp. (see J. P. Smith, 1903, p. 112).

Stratigraphical range.—*Imitoceras rotatorium* has been found at Tournai in the Calonne limestone (Upper Tournaisian). In N. America it is recorded from the Rockford limestone (Indiana) of Tournaisian age.

Munsteroceras sp. (Pl. V. fig. 9.)

The only specimen collected has the following characters: whorls slightly compressed, rounded ventrally, sides flattened, maximum width near the umbilicus, umbilical shoulders subangular, umbilical walls step-like; no surface ornaments are visible. Only part of the suture-line can be seen near the oral end; it shows a long and narrow ventral lobe with a minute saddle in the middle.

By its general form, and principally by the characteristic shape of the umbilicus, this specimen is nearly related to *Munsteroceras oweni* Hall sp. (see J. P. Smith, 1903, p. 120, pl. xix. fig. 3). It may also be compared with *Munsteroceras perspectivum* (de Koninck) (1880, pl. xlix. fig. 8), but in the figure given by de Koninck the umbilical wall is steeper and the umbilicus itself is deeper. The type-specimen in the Brussels Natural History Museum is in that way markedly different from the published restoration.

Nautellipsites (?) sp. (Pl. V. figs. 10-12.)

I refer to this genus a somewhat deformed fragment of a goniatite with a compressed involute shape and a small umbilicus. The dimensions are

D.	H.	W.	h.	U.
20	12	10 (?)	6	2.5

The suture-line has a moderately deep ventral lobe with a minute median saddle; the lateral lobe is V-shaped, and there is a broad internal lateral saddle. The siphuncle is visible, owing to slight erosion of the surface of this internal cast.

The character of the umbilicus with steep, non-grad-umbilicate walls (as far as can be seen) shows that this goniatite is to be included in the genus *Nautellipsites* Parkinson* and not in *Munsteroceras* Hyatt. Nevertheless this Australian goniatite may be compared with the young specimens of *Munsteroceras rotella* (de Koninck), which this Belgian palæontologist described as *Goniatites belvalianus*. They also have a narrow and steep-walled umbilicus in the young, but at a larger size the shell becomes less involute and the umbilical walls are step-like only on the outer part. Unfortunately the Merlewood specimen is too badly preserved to allow of a definite statement as to whether it is related to the young specimens of the *rotella*-group or is perhaps a new species of *Nautellipsites*.

CONCLUSIONS.

The fact that the genera *Protocanites* †, *Imitoceras*, and *Munsteroceras* are found together in the Merlewood goniatite fauna undoubtedly shows that the horizon from which it was collected is of Tournaisian age, as already pointed out by S. W. Carey and Miss I. Brown (1937).

* L. F. Spath (1934, p. 15, footnote) has pointed out that the name *Nautellipsites*, given by Parkinson (1822), has to be revived.

† A. K. Miller's statement (1936, p. 71) that in Europe the genus *Protocanites* is known in the Upper Devonian as well as in the Lower Tournaisian can no longer be maintained; it was due to the fact that German authors wrongly assumed that the *Gattendorfia*-zone was of Upper Devonian age. It has been demonstrated that the *Wocklumeria*-zone is to be correlated with the Etroeungt-beds in the Franco-Belgian Basin; hence the *Gattendorfia*-zone is of Lower Tournaisian age, and all the known species of *Protocanites* in Europe have been collected from Tournaisian beds.

Divisions.	Zones.	Franco-Belgian Basin (main formations).	Goniatites (main zones).	Fossiliferous horizons and divisions in Merlewood sections.	
				<i>Amgydalophyllum</i> .	Lower Kuttung.
Upper Viséan	D	Calcaire de Visé.	<i>Goniatites striatus</i> , <i>crenistris</i> , etc.	Horizon 3 (?) *.	Burndi Series.
Lower Viséan	C 2-S	Marbre noir de Dinant (+ Waulsortian phase).	<i>Munsteroceras</i> <i>inconstans</i> .	Horizon 2.	
Upper Tournaisian	C1	Calcaire de Calonne. Calcaire de Vaulx (+ petite granite and Waulsortian phase).	<i>Protoceras lyoni</i> , <i>Imitoceras rotatorium</i> , <i>Munsteroceras rotella</i> .	Horizon 1 (?).	
Lower Tournaisian		Calcschistes de Maredekous. Calcaire de Landelies. Schistes à <i>Spiriferina</i> . Calcaire d'Hastière.	<i>Imitoceras</i> sp., <i>Gattendorfia</i> .		

* Currabubula horizon not in the same section.

p. 353). But it is possible to give an even more precise opinion, since *Protocanites lyoni* (M. & W.) and *Imitoceras rotatorium* (de Kon.) are only known in the Tournai area from Upper Tournaisian beds. The second fossiliferous horizon in the Merlewood section, where these two species of goniatites also occur (together with *Protocanites australis*, sp. n., and *Munsteroceras* sp., ex. gr. *M. oweni* Hall), may thus be correlated with the Vaulx and the Calonne limestones, which represent the Upper Tournaisian in the Tournai section. The equivalents of this level in the classical Carboniferous section of England are the C 1 beds. In North America *Munsteroceras oweni* (Hall) has been found in the Rockford limestone, together with *Protocanites lyoni* (M. & W.) and *Imitoceras rotatorium* (de Kon.) (= *ixion* Hall).

It may be assumed, from the presence of *Spirifer bisulcatus* Sow. in a list of fossils recorded by Miss Brown (1937, p. 353), that the third fossiliferous horizon occurring in the Burindi Series, in another section near Currabubula, should be correlated with some horizon in the Lower Visean. But there is evidence, as shown by Miss Brown, that in the Merlewood section the coral fauna, with species of *Amygdalophyllum* and *Lithostrotion*, collected from a fossiliferous horizon near the top of the Lower Kuttung beds, is of Upper Visean age, the same as the coral fauna described by Miss D. Hill from the Queensland Carboniferous Limestone.

The table on p. 393 shows these correlations.

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EXPLANATION OF PLATE V.

Note.—All the figured specimens have been collected in the Merlewood section, from horizon 2 of the Burindi Series. These goniatites are preserved in the Geological Department, University of Sydney, Australia.

- Fig. 1.* *Protocanites lyoni* (Meek & Worthen). Lateral view, with suture-lines.
- Fig. 2.* *Protocanites lyoni* (M. & W.). Fragment of another specimen.
- Fig. 3.* *Protocanites lyoni* (M. & W.). Lateral view of a young specimen.
- Fig. 4.* *Protocanites australis*, sp. n. Holotype, lateral view.
- Fig. 5.* The same; front view.
- Fig. 6.* Part of the same enlarged ($\times 3$), to show suture-lines.
- Fig. 7.* *Invitoceras* aff. *rotatorium* (de Koninck).
- Fig. 8.* The same; ventral side, with ventral lobe.
- Fig. 9.* *Munsteroceras* sp.
- Fig. 10.* *Nautellipsites* (?) sp., nat. size.
- Fig. 11.* The same; frontal view, with siphuncle.
- Fig. 12.* The same, enlarged ($\times 2$); lateral view, with umbilicus visible.

XXV.—Notes on the Nomenclature of Fossil Fishes.—

Part III. *Homonyms M-Z*. By ERROL I. WHITE, D.Sc., British Museum (Natural History), and J. A. MOY-THOMAS, M.A., Department of Zoology and Comparative Anatomy, Oxford.

In the first and second parts (Ann. & Mag. Nat. Hist. (11) v. p. 502, June 1940, and *ibid.* vi. p. 98, July 1940) we published notes on the homonyms A-C and D-L respectively, corresponding with parts I. and II. of Dr. S. A. Neave's 'Nomenclator Zoologicus' (Zool. Soc. London, 1939): in this we deal with those beginning M-Z, corresponding to the third part of Dr. Neave's work, published in the summer of last year (1940) and to the fourth part, due to appear this winter, of which we have had the privilege of studying the galley.

(*Coelosteus* Gross, 1930, *non* Newberry, 1887 (Pisces), has been replaced by *Hybosteus* Gross, 1933, *Palæontogr.* lxxix. A, p. 62, which had been omitted from the Zoological Record: *Grossosteus* W. & M.-T., 1940, *Ann. & Mag. Nat. Hist.* (11) v. p. 506, is therefore unnecessary.)

Macrostoma Agassiz, 1838, *Poiss. Foss.* iv. p. 15; *ibid.* pl. xxx. (1939); *ibid.* p. 260 (1842), *non* Risso, 1826, *H. N. Europe Mer.* iii. p. 447 (Pisces), is renamed *Woodwardichthys*, *nom. nov.* (after Sir A. Smith Woodward, F.R.S.).

Megalopterus Kner, 1866, *non* Boie, 1826 (Aves), *nec* Smith, 1836 (Aves), is based on an isolated caudal region without positive generic characters, and should not be renamed until the necessity is proved.

Megalurus Agassiz, 1833, *non* Horsfield, 1821 (Aves), must be replaced by *Urocles* Jordan, 1919, as *Synergus* Gistel, 1848, set up to replace it, had itself already been used by Hartig, 1840 (Hym.).

Microcoelia v. d. Marck, 1863, *Palæontogr.* xi. p. 48, *non* Guenée, 1852, *Hist. nat. Ins. Spec. Gen. Lep.* v. p. 33 (Lep.). is renamed *Sedenhorstia*, *nom. nov.*

Microcentrum Arambourg, 1927, *Mat. Carte géol. Algér.* (1) vi. p. 75. *non* Scudder, 1862, *Boston J. Nat. Hist.* vii. no. 3, p. 446 (Orth.), is renamed *Africentrum*, *nom. nov.*

Microps Agassiz, 1833, *non* Dahl, 1823 (Col.), *nec* Wagler, 1828 (Aves). *nec* Wagler, 1830 (Amphib.), is probably a synonym of *Pholidophorus* Agassiz, 1832, *teste* Woodward, 1895, p. 447.

Nemopteryx Agassiz, 1844, *non* Leach, 1815 (Neuropt.), must be replaced by *Palæogadus* v. Rath, 1859.

Ommatolampes Fischer de Waldheim, 1851, *non* Schoenherr, 1838 (Col.), is probably a synonym of *Xiphiorhynchus* van Beneden, 1871, *teste* Woodward, 1901, p. 490.

Opsigonus Kramberger, 1882, *non* Baudi, 1877 (Col.), is a synonym of *Ionoscopus* Costa, 1853. *teste* D'Erasmus, 1915. *Pal. Ital.* xxi. p. 5.

Orthodon Coquand, 1862. *non* Girard, 1856 (Pisces), is possibly a synonym of *Scyliorhinus* Blainville, 1816, *teste* Woodward, 1889, pp. 343-4.

Orthognathus Barkas, 1873. *non* Buquet, 1837 (Col.). *nec* Schoenherr, 1838 (Col.). is a synonym of *Rhizodopsis* Young, 1866. *teste* Woodward, 1891, p. 354.

Oxygnathus Egerton, 1854, *non* Dejean, 1826 (Col.), must be replaced by *Cosmolepis* Egerton, 1858, which has page-priority over *Thrissonotus* Egerton, 1858, a *nomen nudum* of Agassiz, 1844.

Oxypristis Hoffman, 1912, Zool. Jahr. Anat. xxxiii. p. 334, *non* Signoret, 1861, Ann. Soc. ent. France (3), viii. (1860), p. 937 (Hemipt.), is renamed **Anoxypristis**, *nom. nov.*

Pachygaster Giebel, 1847, *non* Meigen, 1803 (Dipt.), *nec* Germar, 1817 (Col.), is not determinable, *teste* Woodward, 1901, pp. 519–20.

Pachylepis Quenstedt, 1858, *non* Pander 1856 (Pisces), is a synonym of *Thelodus* Agassiz, 1839, *teste* Woodward, 1891, p. 158.

Palaeaspis Clappole, 1884, Amer. Nat. xviii. no. 12, p. 1224, *non* Gray, 1870, Cat. Shield Rept. Brit. Mus. i. Suppl. pp. 71, 73 (Rept.), is renamed **Americaspis**, *nom. nov.*

Palæoscyllium v. d. Marck, 1863, *non* Wagner, 1857 (Pisces), is probably a synonym of *Scyliorhinus* Blainville, 1816 (*Scyllium* Cuvier, 1817), *teste* Woodward, 1889, p. 343.

Pamphractus Agassiz, 1844, *non* Illiger, 1811 (Mamm.), is a synonym of *Bothriolepis* Eichwald, 1840, *teste* Woodward, 1891, p. 223.

Parequula Sauvage, 1880, *non* Steindachner, 1879 (Pisces), is a synonym of *Caranx* Cuvier, 1817, *teste* Arambourg, 1925, Ann. Paléont. xiv. p. 74.

Pelecyphorus Trautschold, 1890, *non* Dejean, 1834 (Col.), *nec* Nordmann, 1837 (Col.), *nec* Agassiz, 1846 (Col.), is based on an imperfect Arthrodiran plate that is insufficient to differentiate this from other genera.

Pelonectes Gisl. 1848, *non* Fitzinger, 1843 (Amphib.), is a synonym of *Acanthodes* Agassiz, 1833 (*Acanthoessus* Agassiz, 1832), *teste* Woodward, 1891, p. 2.

Petalodopsis Davis, 1883, *non* Barkas, 1874 (Pisces), is a synonym of *Ctenoptychius* Agassiz, 1838, *teste* Woodward, 1889, p. 50.

Phalacrus Agassiz, 1845 (*nom. nud.*), *non* Paykull, 1800 (Col.), has been replaced by *Eothyunnus* Woodward, 1901.

Platops Owen, 1854, *non* Newport, 1844 (Myr.), has been replaced by *Brychaetus* (Agassiz MS.) Woodward, 1901.

Platyacanthus Woodward & Sherborn, 1890, *non* Fritsch, 1889 (Pisces), is a synonym of *Oracanthus* Agassiz, 1837, *teste* Woodward, 1891, p. 135.

Platyaspis v. Koenen, 1895, *non* Agassiz, 1846 (Hem.), *nec* Sars, 1870 (Crust.), *nec* Monticelli, 1892 (Verm.), is based on a fragmentary specimen, and not yet clearly differentiated from other Arthrodiran genera.

Platycephalus Agassiz, 1844. *non* Stephens, 1826 (Aves), *nec* Wiedemann, 1830 (Dipt.), is a *nomen nudum* based on an indeterminable decaying head. *teste* Woodward, 1901, p. 612.

Platygnathus Agassiz, 1844. *non* Audinet-Serville, 1832 (Col.), *nec* Owen, 1840 (Rept.), *nec* Krøyer, 1841 (Mamm.), is a synonym of *Holoptychus* Agassiz, 1840 (*Holoptychius* Miller, 1841), *teste* Woodward, 1891, p. 322.

Podopteryx Sauvage, 1880. *non* Selys, 1871 (Odon.), is a synonym of *Bregmaceros* Thompson, 1840, *teste* Arambourg, 1925, Ann. Paléont. xiv. p. 58.

Protacanthodes Fritsch, 1892, Fauna der Gaskohle, iii. pp. 49, 55. *non* Gill, 1888, Amer. Natural. xxii. p. 448 (Pisces), is renamed **Pseudacanthodes**, nom. nov.

Pternodus Garman, 1885. *non* Owen, 1867 (Pisces), is a synonym of *Phæbodus* St. John & Worthen, 1875, *teste* Woodward, 1889, p. 27.

Ptychaspis Bryant, 1935, Proc. Amer. Phil. Soc. lxxv. p. 127, *non* Hall, 1863, Ann. Rep. N.Y. Cab. xvi. app. D. p. 170 (Trilob.), is renamed **Euptychaspis**, nom. nov.

Rhinellus Agassiz, 1840. *non* Bonaparte, 1831 (Amphib.), must be replaced by *Ichthyotringa* Cope, 1878.

Sarmata Boghachev, 1933, *non* Dybowski & Grochmalicki, 1920, is based on fragmentary remains, and need not be renewed until proof of its individuality is forthcoming.

Semiothorus Agassiz, 1935, Poiss. Foss. iv. p. 34 (*nom. nud.*); 1838, *ibid.* p. 14; 1842, *ibid.* p. 219, *non* Wagler, 1830, Nat. Syst. Amphib. p. 152 (Rept.), is renamed **Exellia**, nom. nov. (after A. W. Exell).

Sicarius Leidy, 1855, *non* Walckenaer, 1843 (Arachn.), is a synonym of *Petalodus* Owen, 1840, *teste* Woodward, 1899, p. 42.

Sigmodus Waagen, 1879, *non* Bonaparte, 1850 (Aves), is based on an isolated tooth of uncertain affinities, and not worth renewing, *teste* Woodward, 1891, p. 366.

Smithites Jordan & Gilbert, 1919, Publ. Stanford Univ.,

Univ. Ser. xxxviii. p. 30, *non* Lemoine, 1915, Rev. crit. Paléozool. xix. p. 154 (Moll.), is renamed *Jorbertia*, nom. nov.

Solenognathus Pictet & Humbert, 1866, *non* Agassiz, 1846 (Pisces), *nec* Bleeker, 1856 (Pisces), must be replaced by *Charitosomus* v. d. Marck, 1885, *teste* Woodward, 1901, p. 271.

Spaniolepis Gorganović-Kramberger, 1905, Beitr. Pal. Oesterr.-Ungarns. xviii. p. 216, *non* Kolbe, 1894, Ann. Soc. entom. Belgique, xxxviii. pp. 552, 562 (Col.), is renamed *Dandya*, nom. nov. (after J. E. Dandy).

Sphenolepis Agassiz, 1844, *non* Nees, 1834 (Hym.), has been replaced by *Notogoneus* Cope, 1885.

Stenostoma Dixon, 1850, *non* Latreille, 1810 (Col.), *nec* Lamarck, 1817 (Moll.), is a synonym of *Berycopsis* Dixon, 1850, *teste* Woodward, 1901, p. 433.

Stylorhynchus Martin, 1873, *non* Lesson, 1847 (Aves), *nec* Stein, 1848 (Prot.), is a synonym of *Belonorhynchus* Bronn, 1858 (= *Saurichthys* Agassiz, 1834), *teste* Woodward, 1895, p. 9.

Synergus Gistel, 1848—see *Megalurus* Agassiz, 1833.

Tachynectes v. d. Marck, 1865, *non* Fitzinger, 1843 (Rept.), comprises imperfectly defined species, probably of Scopelidæ, and has as yet no proper generic standing.

Tæniodus St. John & Worthen, 1883, *non* Gervais, 1859 (Mamm.), is a synonym partly of *Psephodus* (Agassiz MS.) Morris & Roberts, 1862, and partly of *Deltodus* (Agassiz MS.) Morris & Roberts, 1862, *teste* Woodward, 1889, pp. 176, 195.

Tetragonolepis Agassiz, 1833, *non* Bronn, 1830, is a synonym of *Dapedium* Leach, 1822, *teste* Woodward, 1895, p. 128.

Thaumas v. Münster, 1842, *non* Huebner, 1819 (Lepid.), *nec* Ehrenberg, 1832 (Prot.), is a synonym of *Squatina* Duméril, 1806, *teste* Woodward, 1889, p. 65.

Thelodus Schmidt, 1861, *non* Agassiz, 1838 (Pisces), is a synonym of *Colobodus* Agassiz, 1844, *teste* Woodward, 1895, p. 68.

Tomodus (Agassiz MS.) Davis, 1883, Trans. R. Dublin Soc. (2) i. p. 446, *non* Trautschold, 1879, Nouv. Mém. Soc. imp. Nat. Moscou, xiv. p. 55, should be renamed, since *Icanodus* Miller, 1892, is based on *T. limitaris* St. John & Worthen (1883, Pal. Illinois, vii. p. 173), which in our opinion is not congeneric with the genotype.

T. convexus Davis. we therefore propose **Eutomodus**, nom. nov., for the original form.

Trachylepis Pander, 1856, *non* Fitzinger, 1843 (Rept.), is not properly identifiable, and should not be renamed.

Trigonodus Newberry & Worthen, 1866, *non* Alberti, 1864 (Moll.), is a synonym partly of *Psephodus* (Agassiz MS.) Morris & Roberts, 1862, and partly of *Sandalodus* Newberry & Worthen, 1866, *teste* Woodward, 1889, p. 185.

Trigonodus Winkler, 1876, *non* Alberti, 1864 (Moll.), *nec* Newberry & Worthen, 1866 (Pisces), is a synonym of *Squatina* Duméril, 1806, *teste* Woodward, 1889, p. 65.

Tripterus M'Coy, 1848, *non* Agassiz, 1846 (Pisces), is a synonym of *Osteolepis* Valenciennes, 1829, *teste* Woodward, 1891, p. 368.

Typodus Quenstedt, 1858, *non* Meyer, 1847 (Pisces), is apparently a synonym of *Gyronechus* Agassiz, 1844 (*Mesodon* Wagner, 1851, *non* Rafinesque, 1819 (Moll.) *Macromesodon* Blake, 1905), *teste* Woodward, 1895, pp. 199, 215.

Urolepis Bellotti, 1857, in Stoppani, *Studii Geol. Pal Lombardia*, p. 431, *non* Walker, 1846, *List Hymen. Coll. Brit. Mus.* i. p. 26 (Hym.) is renamed **Aneurolepis**, nom. nov.

Uronemus Agassiz, 1844, *non* Rafinesque, 1815 (Analyse, p. 135), is still valid, as in the earlier usage the name was a *nomen nudum*.

Vidalia Sauvage, 1903. *Mem. R. Acad. Cienc. Barcelona* (3), iv. pp. 468, 479, *non* Robineau-Desvoidy, 1830 *Mém. prés. Acad. roy. sci. Inst. France*, ii. p. 719 (Dipt.), is renamed **Vidalamia**, nom. nov.

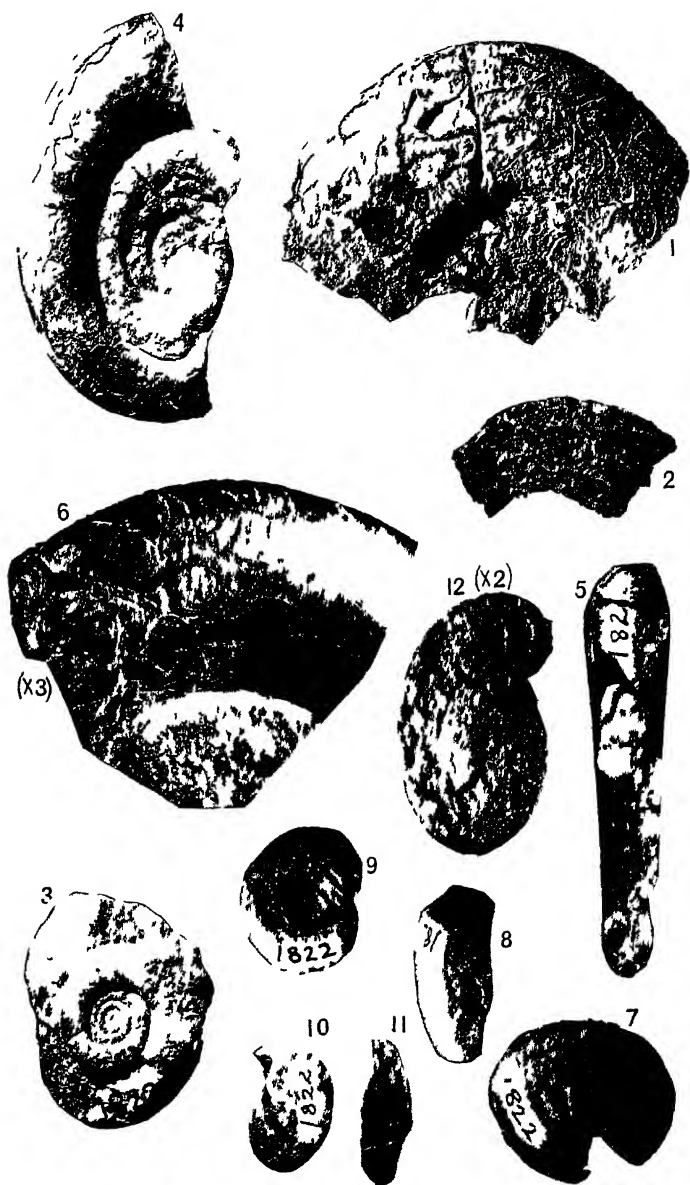
Watsonia Piveteau, 1935, *non* de Folin, 1880 (Moll.), *nec* Elwes & Edwards, 1879 (Lep.), *nec* Tutt, 1906 (Lep.), has been renamed *Watsonulus* Brough, 1939 (*Triass. Fishes Besano* [Brit. Mus. Nat. Hist.]), p. 91.

Xenopholis Davis, 1887, *Trans. Roy. Dublin Soc.* (2) iii. p. 548, *non* Peters, 1869, *Monatsber. Akad. Wiss. Berlin*, 1869, p. 440 (Rept.) is renamed **Trewavasias**, nom. nov. (after Ethelwyn Trewavas).

Zaphleges Jordan & Gilbert, 1920, *Stanford Univ. Publ. (Foss. Fishes Lompoc)*, p. 23, *non* Foerster, 1868, *Verh. naturk. Ver. Rheinl. xxv.* p. 184 (Hym.) is renamed **Euzaphleges**, nom. nov.



Skull of *Hemibos palæstinus*, sp. n.



Carboniferous Goniatites from New South Wales.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

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XXXI.—*The Indian and African Species of Rhaconotus Ruthe.* (Hym., Braconidæ). By G. E. J. NIXON, B.A., Imperial Institute of Entomology.

SOME time ago the Director of the Imperial Institute of Entomology asked me to find a name for a species of *Rhaconotus* which had been sent to him from India with an urgent request for specific identification. The insect proved to be new and, in studying it, I felt it would be a pity not to describe at the same time the closely allied species of the genus existing among the Doryctine material collected by Mr. R. E. Turner in South Africa. Then came the idea that it might be still more useful if I took into account, in one way or another, all the species known to occur in both India and Africa. The outcome of these thoughts is the following paper.

The investigation has been based primarily on a study of the genotype and twelve new species are described, the types of all of which are in the British Museum.

Subfamily DORYCTINÆ.

The genotype of *Rhaconotus*, *R. aciculatus* Ruthe, is in the British Museum. I redescribe it as follows :—

Rhaconotus aciculatus Ruthe.

♀.—Brownish red with the mesosternum, propodeal region and scutellar region and the base of tergite 1,
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darkened. Legs pale brown with a faint reddish tint. Antenna dark brown with the scape, pedicel and first three segments of the flagellum pale brownish yellow. Palpi brownish yellow. Fore wing with a faint brownish cloud at middle and another beneath the stigma enveloping the 2nd cubital cell; stigma brown, yellowish on basal third.

Head somewhat subcubical in appearance, a little narrower behind the eyes than across them. Face and cheeks with a glistening scaly-reticulation. Vertex, frons and temples with similar sculpture. Antenna with 28 segments; flagellum 1 as long as 2; hairs of basal flagellar segments short and inconspicuous. Malar space to long axis of eye as 7:10. Ocellocular line about two and one-third times the distance between the posterior ocelli.

Thorax: Pronotum with rather prominent apical corners, rather long and with a sharp transverse median ridge. Mesonotum sloping very gradually to the pronotum, its lobes covered with glistening, and on the middle lobe broken, scaly-reticulation; only a very few setiform hairs present, fewer, for example, than in *numitor*, sp. n. (cf. fig. 4); notauli well defined; two very fine ridges in the posterior mesonotal depression, which is rather deep. Postscutellum in profile showing as a minute spinose projection. Propodeum rather long (fig. 13) and without a posterior declivity; basal carina distinct to about half; on each side of it an area of shining wide-meshed scaly-reticulation; surface of the propodeum otherwise vaguely rugose-reticulate; dorsal areas undefined. Mesopleural furrow very feebly costate; disc of the mesopleura with wide-meshed scaly-reticulation. Fore wing much as in *thestor*, sp. n. (cf. fig. 1), but the 1st abscissa of the radius less obliquely placed, hence the angle between it and the 2nd abscissa sharper; the proximal extremity of the 2nd cubital cell is more prolonged to a point; recurrens joined virtually with the distal corner of the 2nd discoidal cell. Legs: all the femora with a blister-like swelling on upper surface just proximal to middle; hind coxa with a well-developed basal projection; hairs of outer side of the hind tibia just a trifle shorter than the width of the tibia; apical lobe of the hind tibia with two hardly visible spines; hind tarsus 3 as long as 5; hind tarsus 4 twice as long as wide.

Abdomen : Tergite 1 one and one third times as long as apically wide, covered with wrinkly striation. Tergite (2+3) with a broad furrow just posterior to middle ; anterior to this furrow there is the faintest indication of a second, extremely shallow, furrow, visible when the tergite is viewed from the side ; the transverse median area thus delimited is very slightly raised, its surface and all that of the surface anterior to it, sculptured like tergite 1 ; posterior to the broad furrow, the surface is very finely, smoothly striated, but towards the sides and on lateral declivous part, the sculpture becomes merely finely rugulose with weak longitudinal elements. Tergite 4 sculptured like the apical part of (2+3) and with a deep furrow at base. Tergite 5 large, forming the virtual apex of the abdomen, in shape much like that of *thestor*, sp. n. (cf. fig. 26), but seen from above the posterior margin rather more rounded ; its setiform hairs are very sparse ; sculpture like that of 4, except that apically there is an indication of vague wide meshed scaly-reticulation. Tergite 6 projecting a little beyond 5. Tergites (2+3)-5 sharply margined laterally, their epipleuræ membranous and virtually hairless. The ventral part of tergite 6 is also sharply reflexed, but there appears to be no differentiated lateral margin as in the case of the other tergites. The epipleuræ of the morphologically true 2nd and 3rd tergites are not fused. Ovipositor about two-thirds the length of the abdomen.

Length : 3 mm., without ovipositor.

GERMANY : Near Berlin, Hasenheide, 15. vi. 1853 (*Ruthe Coll.*).

This is the only species of *Rhaconotus* so far known from Europe. It is a very feebly characterized insect. Important for its recognition are probably the rather long pronotum with its rather prominent corners and the fewness of the mesonotal hairs.

The genus *Rhaconotus* can be briefly diagnosed as follows :—

Vertex of the head almost always with a fine sculpture of scaly-reticulation ; only exceptionally is this sculpture smoothed out to the point of being virtually wanting as in *mahensis* Wilkinson, an aberrant member of the genus ; more frequently raised rugosities are superimposed on the fine ground sculpture as in several of the species described below. Antennæ of simple form. Recurrens

of the fore wing always received into the extreme base of the second cubital cell; nervus parallelus always interstitial. Hind coxa always with a dentiform projection beneath at base; all the femora with a blister-like swelling on upper surface just posterior to middle. Abdomen appearing to consist of four segments, comprising tergites 1, (2+3), 4 and 5, all of which are very strongly sclerotized and have a completely differentiated, sharp, lateral margin. Tergite 6 usually, and 7 and 8 always, retracted, in normal condition of the abdomen, beneath tergite 5; all the exposed tergites with a predominating sculpture of longitudinal striation; the abdomen is gradually, but slightly, widened from base to apex.

Unlike the allied genus *Spathius* (I cannot yet speak for other allied Doryctine genera), the number of spines on the apical lobe of the hind tibia is of no specific importance and varies from two to four.

Key to the Indian and African Species (♀♀).

1. Vertex smooth. (Sp. with the mesonotum almost bare, only a few, rather long hairs, placed at large intervals, being present along the course of the notauli; hairs of the flagellum long and conspicuous (fig. 9), clearly longer than the width of the segments; hairs of the outer side of the hind tibia about twice the width of the tibia; stigma unicolorous, pale flavous; recurrens of the fore wing meeting the nervus parallelus far distal to the apex of the 2nd discoidal cell; abdomen subpetiolate, tergite 1 being twice as wide at apex as at base and $1\frac{1}{2}$ times as long as apically wide; tergite (2+3) with a medial, transverse, shining area which is almost smooth; tergite 5 virtually smooth except for the feebly costate basal furrow; ovipositor sheaths about two-thirds the length of the abdomen)

[Seychelles.
mahensis Wilkinson,

Vertex with at least a fine ground sculpture of scaly-reticulation. (Spp. with the hairs of the flagellum much shorter than in *mahensis*, being much finer, quite inconspicuous and on the whole not longer than the width of the segments.).

2.

2. Tergite (2+3) with a transverse, polished band which separates the sculpture of the basal part of the segment from that of the apical part. (Sp. with the mesonotum densely and evenly clothed with fine, short, more or less recumbent pubes-

- scence; tergite 6 freely exposed and with strong sculpture at least laterally.)
- Tergite (2+3) without such a band, its sculpture being continuous in some form or other, from base to apex 3.
3. Tergite (2+3) with two transverse furrows which divide the segment into three areas, the middle one transverse, fusiform, its sculpture frequently showing a less marked longitudinal element than that of the basal area, being striate-reticulate or sometimes merely reticulate-rugose. (Spp. with the stigma unicolorous, yellowish) 4.
- Tergite (2+3) divided by one transverse furrow into two areas, at most the merest trace of a second furrow being present . . 6.
4. Mesonotum densely and evenly clothed with short, very fine, more or less recumbent pubescence; eyes large, about $2\frac{1}{2}$ times as long as the malar space; dorsal areas of the propodeum sharply defined, dull, scaly-reticulate, all the surface outside them coarsely rugose-reticulate; exposed part of tergite 5, *i. e.*, the area whose basal limit is defined by the discontinuation of striation (there being hardly a trace of a basal furrow) hardly half as long as basally wide (fig. 25). (Dark brown or red-brown spp.; 2nd abscissa of the radius about as long as the 1st intercubitus; hairs of the outer side of the hind tibia semidecumbent, shorter than the width of the tibia; tergite 6 freely exposed and forming the virtual apex of the abdomen; tergite 5 truncate at apex in a dorsal view, its broad apical margin completely smooth (fig. 25)).
5. Group of *menippus* [Nixon.
- Mesonotum clothed only sparsely with more or less erect hairs, the lateral lobes virtually bare; eyes unusually small, almost exactly equal in length to the malar space; dorsal areas of the propodeum completely undefined; exposed part of tergite 5, *i. e.*, the area in this case delimited by a well-defined furrow, only a trifle shorter than basally wide, 7 : 6. *sulmo*, sp. n., Africa.
5. Ocelli circumscribed by fine broken and/or obsolescent striation; abdomen largely suffused with reddish *menippus* Nixon, India
- Ocelli, at least on the vertex, not thus circumscribed by striation; abdomen mostly black, only the apical margin of the tergites being paler [Nixon, Africa.
6. Stigma unicolorous, pale straw coloured. *menippus* var. *africana*
- Stigma infuscated at least on about apical half 7.
7. That part of the posterior margin of the pronotum which forms the boundary of 10.

- the middle lobe of the mesonotum, obscured, except at sides, on account of the pronotum immediately in front of it being raised above it to form a false ridge. (Sp. with the pro- and mesonotum thickly and rather characteristically clothed all over with whitish hairs; mesonotum a little longer than its greatest width (fig. 10); antenna with 44-47 segments.) [India.
scirpophagæ Wilk.,
- This part of the posterior margin of the pronotum not thus obscured, smooth, sharp, entire 8.
8. Middle lobe of the mesonotum hairy all over. (Sp. with the pro- and mesonotum almost as hairy as in *scirpophagæ*, but the hairs less characteristically arranged on the mesonotum and the mesonotum itself very slightly transverse; antenna with 30-32 segments.) *oryzæ* Wilk., India.
- Middle lobe of the mesonotum, except along sides, free from hairs. (Whatever mesonotal hairs are present are thick, setiform, recumbent and crowded along the course of the notauli; legs pale throughout.) 9.
9. Ovipositor projecting beyond the apex of the abdomen by a distance equal to about one-third its length; vertex with traces of vermiculate rugulosities superimposed on the ground sculpture *ochus*, sp. n., Africa.
- Ovipositor projecting beyond the apex of the abdomen by a distance equal to about one half its length; vertex with no trace of rugulosities superimposed on the even ground sculpture *manolus*, sp. n., Africa.
10. Ridges of tergite 5 very strong, reaching the apical margin and in part running parallel with it, thus presenting a concentric appearance; mesonotum densely clothed with fine, short hairs all over .. *hypolixi*, sp. n., India.
- Ridges of tergite 5 much less strong, fading out long before reaching the apical margin and leaving a pale apical area which is shining and more or less scaly-reticulate; mesonotum with at least the middle part of all its lobes free from hairs 11.
11. Scutellum strongly convex; hairs of the outer side of the hind tibia very short, set at about 30 degrees and much shorter than the width of the tibia. (Sp. with the fore wing sharply dappled.) *atys*, sp. n., Africa.
- Scutellum at most feebly convex; hairs of the outer side of the hind tibia outstanding, at least equal to the width of the tibia 12.
12. Tergite 5 in profile, emarginate close to the ventral surface of the abdomen, evenly deep reddish brown; propodeum with a few thickened, obsolescent, longitudinal keels, its entire surface, including that

- of the keels themselves, overlaid with a glistening, more or less scaly-reticulate ground sculpture. (Sp. with the fore wing dappled; median cell of the hind wing very narrow, clearly a little constricted at middle.) *cleantes* Nixon, India.
- Tergite 5 in profile entire; dark at base and with a pale apical area; propodeum not as above 13.
13. Declivous sides of tergites (2+3)-5 and the apical area of tergite 5, deep reddish. (Sp. with the vertex unevenly but distinctly transversely striate; red parts of the abdomen contrasting rather sharply with the dark parts.) *hyperion*, sp. n., Africa.
- Declivous sides of these tergites as dark or darker than the upper surface 14.
14. Declivous sides of tergites (2+5)-5 deeply and evenly striate, the resultant ridges equal in strength to those of the dorsal surface of the segments 15.
- Declivous sides of tergites (2+3)-5 without or with only obsolescent striation 17.
15. Fore wings very distinctly dappled 16.
- Fore wings more or less evenly tinted throughout. (Sp. with the ovipositor sheaths about three-quarters the length of the abdomen.) *troilus*, sp. n., Africa.
16. Legs in greater part dark brown; propodeum without a trace of a basal carina; ovipositor sheaths nearly as long as the abdomen *iphias*, sp. n., Africa.
- Legs almost entirely pale honey brown; propodeum with a distinct though irregular basal carina; ovipositor sheaths less than half the length of the abdomen. [Africa.
- polycrates*, sp. n.,
17. 3rd abscissa of the radius twice as long as the 2nd. (Sp. with the fore wing nearly hyaline; stigma somewhat short and wide (fig. 2); tergite 1 as long as apically wide.) *sciron*, sp. n., Africa.
- 3rd abscissa of the radius at most $1\frac{1}{2}$ times as long as the 2nd 18.
18. Stigma emitting radius considerably beyond the middle; vertex usually with feeble transverse rugosities superimposed on the scaly-reticulate ground sculpture; hind femora almost entirely brown *numitor*, sp. n., Africa.
- Stigma emitting radius virtually at middle; vertex without a trace of transverse rugosity; hind femora uniformly pale honey brown or honey yellow 19.
19. Ovipositor projecting beyond the apex of the abdomen by a distance equal to about two-thirds the length of the abdomen; stigma pale all along the edge of the wing. [Sudan.
- sudanensis* Wilk.,
- Ovipositor projecting beyond the apex of the abdomen by a distance a little less than half the length of the abdomen; stigma not pale all along the edge of the wing *thektor*, sp. n., Africa.

Rhaconotus ollivieri (Gir.).

Hormiopterus ollivieri Giraud, 1869, Bull. Soc. ent. Franco, 9 (4), 478.
Rhaconotus ollivieri (Gir.), Nixon, 1940, Ann. & Mag. Nat. Hist. ser. 11, p. 493.

This species is not included in the foregoing key for I have no material compared with the original specimen on which the above synonymy was based.

ALGERIA: bred from a gall-making lepidopterous larva on *Limoniastrum guyonianum*.

Rhaconotus sulmo, sp. n.

♀.—Entirely pale brownish yellow. Fore wing evenly pale brownish yellow all over; stigma pale straw yellow; veins brown.

Head transverse, clearly narrower behind the eyes than across them. The eyes very prominent, small, their long axis equal to the length of the malar space. Face evenly scaly-reticulate. Frons and vertex with raised rugulosities superimposed on the scaly-reticulate ground sculpture; those on the vertex form transverse, much broken raised lines. Antenna broken but with at least 36 segments; the flagellum rather thick; flagellar segment 1 clearly longer than 2, 11:9. Ocellocular distance $4\frac{1}{2}$ times as long as the distance between the posterior ocelli.

Thorax elongate. Pronotal collar somewhat swollen, with hardly a trace of the usual raised ridges or carinae; sculpture of the sides of the pronotum on the whole fine, whatever raised rugulosities are present being feeble and inconspicuous owing to the pale colour of the sclerite. Mesonotum a trifle longer than broad, 15:14; its hairs fine, sparse, more or less erect and confined to the course of the notauli; posterior depressed area longitudinally rugulose; the rugulosities fine, close and very wrinkly. Scutellum hardly convex. Postscutellum, in profile, with a weak spinose projection. Propodeum dull, virtually free from longitudinal carinae, the mid-basal carina and the inner lateral carina being indicated only at extreme base; the entire surface of the propodeum, including that of the not discrete metapleura, covered with fine, very weak reticulation on a more or less scaly-reticulate ground sculpture; owing to its pale colour, the sculpture of the propodeum appears very indefinite. Mesopleura

everywhere scaly-reticulate; the furrow narrow, neither costate nor foveolate. Legs: hairs of the outer side of the hind tibia about as long as the middle width of the tibia, set at an angle of about 60 degrees; apical lobe of the hind tibia with five small spines; segment 1 of the hind tarsus not quite twice as long as 2, $7 \cdot 4$; 3 about as long

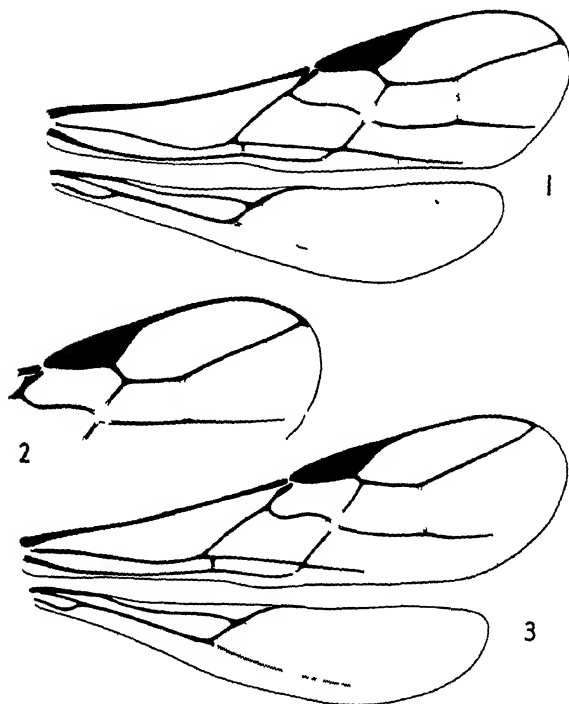


Fig. 1—*Rhaconotus thestor*, sp. n. Wings, ♀.
Fig. 2—*Rhaconotus sciron*, sp. n. Portion of fore wing, ♀.
Fig. 3—*Rhaconotus sulino*, sp. n. Wings, ♀.

as 5. Fore wing: 1st abscissa of the radius very short, almost in a straight line with the 2nd; radial cell somewhat short, ending considerably before the apex of the wing (fig. 3); discocubitus very strongly sinuated.

Abdomen: Tergite 1 one and one half times as long as apically wide, its sculpture of ordinary form, that is,

consisting of fine longitudinal ridges on a rugulose surface. Tergite (2+3) with two transverse furrows of about equal depth, cutting off a transverse, elliptical area. Area of tergite 5 beyond the basal furrow only a little wider at base than long, 7 : 6, slightly narrowed to apex (fig. 30). Ovipositor sheaths a trifle longer than tergite (2+3), less than half the length of the abdomen. Furrow at base of tergites 4 and 5 well defined, its basal edge steeper than its apical; sculpture of surface (usually hidden) basal to the furrow consisting of finer striation than that apical to it.

Length : 5.5 mm. without ovipositor.

CAPE PROVINCE : Pondoland, Port St. John. v. 1924, 1 ♀, the type (*R. E. Turner*).

This species differs from all the others described in this paper by its small eyes and from the group of *thestor*, sp. n., to which it appears to be most closely related, it differs at once in the development of the second furrow of tergite (2+3).

Rhaconotus scirpophagæ Wilkinson.

Rhaconotus scirpophagæ Wilk., 1927, Bull. ent. Res. xviii. p. 34.

Rhaconotus scirpophagæ Wilk., Nixon, 1939, Bull. ent. Res. xxx. p. 123.

This species is chiefly characterized by having the mesonotum distinctly longer than wide and very thickly hairy, the hairs arranged as in fig. 10; by the form of the pronotum as described in the key and by the large number of antennal segments.

The ocell-ocular line is about $2\frac{1}{2}$ times as long as the distance between the posterior ocelli. The shape and vestiture of tergite 5 are hardly different from that of *thestor*, sp. n. (cf. fig. 26).

INDIA : Punjab ; Mysore ; Bihar ; Bengal ; parasite of *Scirpophaga*.

Rhaconotus oryzæ Wilkinson.

Rhaconotus oryzæ Wilk., 1929, Bull. ent. Res. xx. p. 205.

Rhaconotus oryzæ Wilk., Nixon, 1939, Bull. ent. Res. xxx. p. 123.

This species has the mesonotum as hairy as *scirpophagæ* (cf. fig. 10), but the hairs bordering the inner margin of the lateral lobes do not tend to be directed at an angle of 90 degrees to the long axis of the body and in a horizontal plane and the mesonotum is shorter. The pronotum, as stated in the key, has the posterior margin simple.

The ocell-ocular line is as in *scirpophagæ*. Tergite 5 is hardly different from that of *thestor*, sp. n., but the setæ are a little more numerous.

INDIA : Punjab ; bred from borers hibernating in wheat stubble.

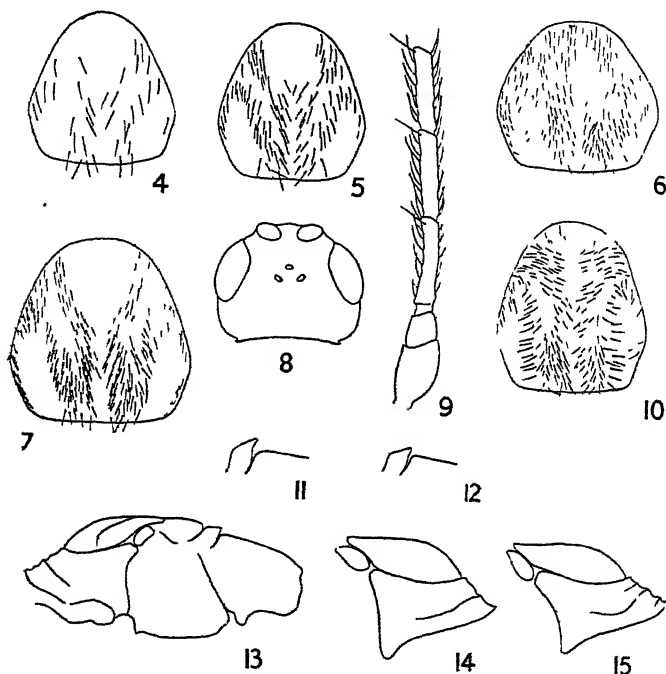
Rhaconotus manolus, sp. n.

♀.—Head dull yellowish, a faint brownish tinge being present ; a dark cloud behind each eye against the occipital margin and a dark streak connecting the ocellar triangle with the occipital margin : the occipital region darkened, brownish. Mesonotum, posterior part or whole of the mesopleura dull reddish ; rest of the thorax more or less brownish. Legs dull yellowish throughout. Abdomen in greater part brownish, but most of the medial surface of tegite 1 and (2+3) and the whole of the delimited apical portion of tergite 5 reddish. Stigma yellow ; the venation otherwise brown.

Head as in *thestor* (see fig. 19) ; Frons and vertex shining, scaly-reticulate and with no trace of raised rugosities ; vertex between the posterior ocelli and the occipital margin as long as the middle length of the pronotum. Ocell-ocular line about two and one-quarter times as long as the distance between the posterior ocelli. Malar space to the greatest length of eye as 8 : 13. Antenna with 31–38 segments (3 ♀♀).

Thorax : Posterior margin of the pronotum simple ; its dorsal surface with a sparse row of cilia near the posterior margin ; elsewhere with a few scattered hairs. Hairs of the mesonotum slightly less numerous than in the following species (*cf.* fig. 7) ; apart from the rugose notauli and the accumulation of rugosities where they meet posteriorly, the sculpture of the lateral lobes consists of fine scaly-reticulation ; that on the middle lobe is less even and could be described as fine rugulosity. Scutellum only very feebly convex, its anterior fovea with 5–6 longitudinal ridges. Postscutellum, seen from the side, showing as an acutely pointed projection (fig. 12). Propodeum : basal carina distinct for about half length of propodeum ; dorsal areas not delimited but their position, at least on each side of the basal carina, marked by fine surface sculpture ; elsewhere the surface of the propodeum shows longitudinal more or less vermiculate

rugosities. Mesopleural furrow rather shallow, transversely costate; disc of the mesopleura evenly scaly-reticulate. Legs: hind coxa with a well-developed dentiform projection; hairs of the outer side of the hind



- Fig. 4.—*Rhaconotus numitor*, sp. n. Mesonotum, ♀.
 Fig. 5.—*Rhaconotus thestor*, sp. n. Same, ♀.
 Fig. 6.—*Rhaconotus hypolixi*, sp. n. Same, ♀.
 Fig. 7.—*Rhaconotus ochrus*, sp. n. Same, ♀.
 Fig. 8.—*Rhaconotus troilus*, sp. n. Head (dorsal), ♀.
 Fig. 9.—*Rhaconotus mahensis* Wilk. Scape, pedicel and first three flagellar segments, ♀.
 Fig. 10.—*Rhaconotus scirpophagæ* Wilk. Mesonotum, ♀.
 Fig. 11.—*Rhaconotus hyperion*, sp. n. Postscutellum (lateral), ♀.
 Fig. 12.—*Rhaconotus mamulus*, sp. n. Same, ♀.
 Fig. 13.—*Rhaconotus aciculata* Ruthe. Thorax (lateral), ♀.
 Fig. 14.—*Rhaconotus troilus*, sp. n. Pronotum (lateral), ♀.
 Fig. 15.—*Rhaconotus polycrates*, sp. n. Same, ♀.

tibia a little shorter than those of *thestor* (cf. fig. 17); apical lobe of the hind tibia with two spines; hind tarsal segment 1 slightly less than twice 2. Fore wing much as in *thestor* (cf. fig. 1), except that the recurrens is

received into the 2nd cubital cell at a distance from the intercubitus equal to about one-quarter its own length (that of *recurrens*).

Abdomen : Tergite 1 about one and two-thirds as long as apically wide, 13 : 5, with fine, even, very slightly wrinkly longitudinal ridges ; the intervals between the ridges glistening, rugulose. Tergite (2+3) with a single curved deep furrow ; the sculpture of the segment anterior to the furrow is similar to that of tergite 1 but *immediately* anterior to the furrow, the sculpture is weaker and finer so that there is indicated a feebly delimited, slightly raised, bolster-shaped area (in *sulmo*, sp. n. and *menippus* Nixon, this area is completely delimited, but in the group of *thestor*, sp. n., it is at most weakly indicated, as in the present species, owing to the complete or almost complete disappearance of the anterior furrow). Pale apical part of tergite 5 with shining, wide meshed scaly-reticulation ; the darkened area striated. Furrow at the base of tergites 4 and 5 sharply delimited along the anterior margin ; the surface (usually hidden) basal to the furrow without longitudinal elements in the sculpture. Vestiture of tergite 5 a little less dense than in *thestor*, sp. n., but shape hardly different (*cf.* fig. 26). The sculpture of the lateral declivous parts of all tergites much finer than that of the dorsal surface. Ovipositor sheaths nearly twice as long as tergite (2+3), 11 : 6, and slightly more than half the length of the whole abdomen.

Length : 3.5–3.8 mm. without ovipositor.

CAPE PROVINCE : Pondoland, Port St. John, iii.–iv. 1923, 4 ♀♀ (one the type, 1–5. iv. 1923) (*R. E. Turner*)

I also refer to this species two females from Natal, Kloof, 1500 ft., ix. 1926 (*R. E. T.*) ; both these females have the mesonotum very slightly less hairy, and one of them is virtually without the dark streak behind the ocelli and the dark patch on the side of the head.

Rhaconotus ochus, sp. n.

This species is allied to *manolus* in having a pale, unicolorous stigma and the posterior margin of the pronotum simple, but is certainly distinct from that species. It differs from *manolus* as follows :—

♀.—Abdomen paler, tergites 1–4 being reddish almost all over.

Head more transverse, similar to that of *hypolixi*, sp. n. (cf. fig. 20). Hairs of the frons and vertex more conspicuous, longer, thicker and more numerous. Vertex lacking the smoothly reticulate appearance of *manolus*, there being indistinct, scattered, fine, vermiculate ruguloseities on the ground sculpture. Antennæ broken but with at least 39 segments (1 ♀). Malar space very slightly longer, 3 : 4.

Hairs of the mesonotum more numerous (fig. 7). Basal carina of the propodeum less well defined, feeble, vague in direction and with two or three carinulae, of equal strength, on either side of it. Apical lobe of the hind tibia with four spines.

Tergite 1 shorter, broader. Ovipositor sheaths shorter, as long as tergite (2+3) and about one-third the length of the whole abdomen. Tergite 5 a little less transverse than that of *thestor*, sp. n., and its setæ more numerous (cf. fig. 26).

Length : 5.5 mm. without ovipositor (size considerably larger than *manolus*).

CAPE PROVINCE : Pondoland, Port St. John, 25-31. iii. 1923, 1 ♀, the type (*R. E. Turner*).

Rhaconotus thestor, sp. n.

♀.—Head yellowish brown, darkened on the face, vertex and along the occipital margin; sometimes the head is more extensively darkened so that only the eyes appear to be margined with paler colouring. Thorax dark brown; lobes of the mesonotum, postero-lateral corner of the pronotum and surface of the mesopleura above the furrow, suffused with paler brown. Tergite (2+3) and 4 with a narrow, ill-defined apical brownish-red margin; about apical half of tergite 5 brownish red; lateral deflected part of tergites (2+3)-5 brown. Legs virtually unicolorous, honey yellow to honey-brown; at most the hind coxæ sometimes darkened basally. Flagellum towards base, and the pedicel yellowish; scape sometimes a little darker than the pedicel but apparently never markedly blackened. Fore wing faintly fuscous; stigma blackened on about apical half.

Head as in fig. 19. Face becoming smooth and shining down the middle; otherwise with close scaly-reticulation, almost shagreened. Malar space to long axis of eye as

8:13. Frons and vertex on the whole evenly scaly-reticulate; no trace of raised rugulosity on the vertex. Antenna with 35-38 segments (6 ♀♀), usually 36-37. Ocell-ocular line about $2\frac{2}{3}$ the distance between the posterior ocelli.

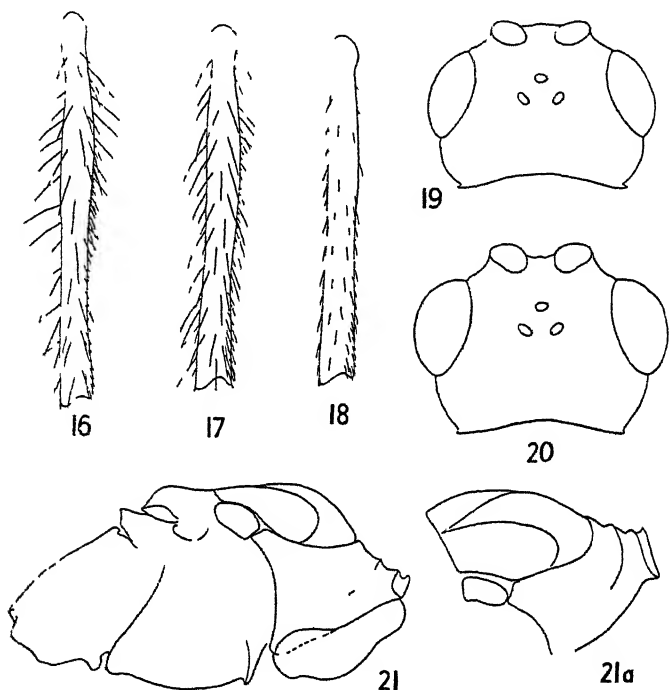


Fig. 16.—*Rhaconotus numator*, sp. n. Hind tibia (dorsal), ♀.

Fig. 17.—*Rhaconotus thestor*, sp. n. Same, ♀.

Fig. 18.—*Rhaconotus atys*, sp. n. Same, ♀.

Fig. 19.—*Rhaconotus thestor*, sp. n. Head (dorsal), ♀.

Fig. 20.—*Rhaconotus hypohixi*, sp. n. Same, ♀.

Fig. 21.—*Rhaconotus atys*, sp. n. Thorax (lateral), ♀.

Fig. 21 a.—Same, to show the lateral emargination of the pronotum.

Thorax: Pronotum as long as the vertex between the posterior ocelli and the occipital margin; its posterior margin simple; roughly two rows of cilia present, one along the feeble medial transverse ridge, the other close to the posterior margin. Mesonotum with closely recumbent, setiform, more or less golden hairs, arranged as in fig. 5; apart from the deep, rugose notauli and the

strongly rugose posterior area, the sculpture of the lobes consists of fine scaly-reticulation, that on the middle lobe less smooth and more broken. Scutellum hardly convex, its curved anterior fovea with 5-6 even longitudinal ridges. Postscutellum seen from the side showing as an acute angulation but hardly spinose. Propodeum with a feebly defined basal carina; no trace of areola nor of dorsal areas; anteriorly the sculpture is fine but posteriorly after about middle it strengthens to form usually feeble longitudinal vermiculate rugosities; sometimes the longitudinal element is so weak that the sculpture is merely rugose-reticulate. Mesopleural furrow rather deep, evenly costate; medial surface of the mesopleura evenly scaly-reticulate. Legs: hind coxa with a well-developed projection beneath; hairs of the outer side of the hind tibia as in fig. 17; apical lobe of the hind tibia with four short, pale spines; segment 1 of the hind tarsus slightly less than twice 2, 9:5. Wings (fig. 1): recurrens of the fore wing virtually interstitial.

Abdomen: Tergite 1 only a little longer than its apical width, 14:11, slightly more than twice as wide at apex as at base, longitudinally striated, the interstices rugulose; the striation is somewhat vermiculate. Tergite (2+3) with a single curved furrow, deepest towards middle; the whole segment covered with striation similar to that of tergite 1 but the ridges more wrinkly. Pale apical part of tergite 5 scaly-reticulate, very shining, its darkened area striated all over. Furrow at base of tergites 4 and 5 deep, sharply delimited along its anterior margin; the surface (usually hidden) basal to the furrow without an obvious longitudinal element in its sculpture. The sculpture of the lateral parts of all exposed tergites with finer sculpture than the dorsal surface and much broken up. Tergite 5 (fig. 26). Ovipositor projecting beyond the apex of the abdomen by a distance equal to less than half that of the abdomen, its sheath a little longer than tergite (2+3), 25:19.

Length: 4.5 mm. without ovipositor.

CAPE PROVINCE: Pondoland, Port St. John, 15-31. viii. 1923, 1 ♀ (*R. E. Turner*); Mossel Bay, xi. 1921-i. 1922, 10 ♀♀, i. 1922, 1 ♂, the type (*R. E. T.*). The female from Port St. John has the ovipositor distinctly longer than those from Mossel Bay.

Rhaconotus sudanensis Wilkinson.

Rhaconotus sudanensis Wilk., 1927, Bull. ent. Res. xviii. p. 36, ♀.

This species is evidently extremely closely related to *thestor*, sp. n., differing from it as follows :—

♀.—Colour paler, the head almost honey yellow. Thorax and abdomen with a much greater extent of reddish suffusion. Fore wing almost hyaline; darkened area of the stigma less extensive; the stigma being virtually pale along the edge of the wing. Antenna with 32–36 segments (5 ♀♀). Tergite 1 and especially that part of (2+3) basal to the furrow less evenly striate. Ovipositor longer, projecting beyond the apex of the abdomen by a distance equal to $2\frac{1}{2}$ times the length of tergite (2+3) or to about two-thirds the length of the abdomen.

Of the above differences the most important and the most readily appreciated is the longer ovipositor of *sudanensis*.

SUDAN: Khartoum, 5 ♀♀, bred xi.–xii. 1924, from cotton stems containing a Buprestid beetle *Sphenoptera gossypii* Cotes (*H. B. Johnston*). In the British Museum are also two males bred from *Sphenoptera* sp. (possibly *gossypii*) (*H. W. Bedford*).

Rhaconotus numitor, sp. n.

♀.—A species very closely allied to *thestor*, sp. n., with which it may be compared as follows :—

Head more extensively darkened, the pale colour reduced to a narrow border around the eyes. Hind coxæ, hind femora and apex of the hind tibiæ infuscated to a greater or less extent.

Vertex on each side usually with a weak indication of transverse rugulosity, forming broken wrinkles. Antennæ with 28–35 segments (6 ♀♀). Mesonotum with fewer setiform hairs (fig. 4). Stigma of the fore wing longer, emitting the radius considerably beyond the middle. Hairs of the upper surface of the hind tibia longer, more erect (fig. 16). Ovipositor longer, its length beyond the abdomen more than twice that of tergite (2+3) and about two-thirds that of the abdomen.

CAPE PROVINCE: Mossel Bay, xi. 1921–i. 1922, 7 ♀♀, one the type (18–31. x. 1921) (*R. E. Turner*).

This species differs also from *sudanensis* Wilk. in all the above details except the long ovipositor. It appears

to be characterized essentially by the infuscation of the hind legs and the length of the stigma together with the position of the point of emission of the radius of the fore wing.

Rhaconotus hyperion, sp. n.

This species differs from *thestor*, sp. n., as follows :—

♀.—Head virtually red-brown all over; in two individuals a dark streak enclosing the ocelli and extending backwards as far as the occipital margin is present. Disposition of the pale areas on the thorax similar, but the pale areas themselves brighter in colour and contrasting fairly sharply with the black propodeum. Apical band of tergite (2+3) and 4 and the large apical area of tergite 5 dull reddish and more sharply delimited; lateral declivous portions of these three segments dull reddish. Antennal scape yellowish like the base of the flagellum. Fore wing less evenly tinted; at least the apical margin of the wing and a large area within the radial cell being very slightly paler than the darkest parts of the wing. Legs with a reddish tint, the coxæ a little infuscated. A decidedly more slender species than *thestor*.

Head slightly narrower behind the eyes, so that the eyes appear more prominent; its shape from above almost intermediate between that of *thestor* and *hypolixi* (cf. figs. 19 & 20). Vertex in three examples with uneven striation right across. *Mesonotum* with far fewer setiform hairs, even less than in *numitor*, sp. n. (cf. fig. 4). Postscutellum in lateral aspect with a distinct spinose projection, the tip of which is slightly bent, backwards (fig. 11). Propodeum a little longer and narrower, its ridges more vermiculate, extending forwards virtually to the anterior margin. Stigma of the fore wing longer and narrower, similar in shape and in regard to the point of emission of the radius to that of *numitor*, sp. n. *Abdomen*: Tergite 1 narrower, fully $1\frac{1}{2}$ times as long as apically wide, its ridges a little more even and sharper than in *thestor*, but the interstices equally rugulose. Furrow at the base of tergites 4 and 5 less deep, not sharply delimited along the anterior margin (this is especially true of 5), the striations which cross the furrow merging almost imperceptibly into the sculpture of the surface basal to the furrow; tergite 5 slightly less narrowed

to apex than in *polycrates*, sp. n. (cf. fig. 28). Length of the ovipositor beyond the apex of the abdomen equal to more than half the length of the abdomen and slightly more than twice the length of tergite (2+3).

CAPE PROVINCE: Pondoland, Port St. John, iii.-iv. 1924, 3 ♀♀, one the type, 1-15. iv. 1924; iv. 1923, 1 ♀ (*R. E. Turner*).

This species also resembles *numitor*, sp. n., in the shape of the stigma of the fore wing, point of emission of the radius and length of ovipositor, but differs in colour, stronger sculpture of vertex and spinose postscutellum.

Rhaconotus sciron, sp. n.

Another species closely allied to *thestor*, with which it may be compared as follows:—

Head slightly more narrowed behind the eyes. Sculpture of the vertex lacking the even appearance characteristic of *thestor*, and with indication of feeble, transverse, linear rugulosities. Antennæ broken, but with at least 26 segments and, to judge from the number of darkened apical segments, probably with about 27-28 segments. Mesonotum very slightly wider than long, 25:24; in *thestor*, it is very slightly longer than wide; pubescence of the mesonotum about as dense as in *numitor*, sp. n. (cf. fig. 4). Fore wing almost hyaline in tint, somewhat shorter and broader than in *thestor*; 3rd abscissa of the radius about two and one-third times longer than the 2nd; stigma decidedly a little shorter and broader (fig. 2). *Abdomen*: Tergite 1 not longer than its apical width. Costæ of the furrow of tergite 5 not extending as striation beyond the furrow itself, except at sides of segment and then only very feebly.

Length: 3.4 mm. without ovipositor.

CAPE PROVINCE: Somerset East, x. 1930, 1 ♀, the type (*R. E. Turner*).

A single female (CAPE PROV.: Ceres, iii. 1925), which is probably referable to this species, has the head above paler than in the type and the vertex without a trace of raised rugulosities, only the scaly-reticulate ground sculpture being present. The antennæ are 23-segmented.

R. sciron, sp. n., differs from *R. hyperion* and *R. numitor* spp. n., in having the second cubital cell of the fore wing and the ovipositor shorter.

Rhaconotus polycrates, sp. n.

♀.—Head yellowish brown, virtually unicolorous. Thorax dark brown with a reddish tint, which varies in intensity but seems to be most apparent on the propodeum. Abdomen chestnut-brown; apical margin of tergite (2+3) and 4 and the large apical portion of tergite 5, reddish. Legs yellowish with brownish tinge, especially noticeable on the hind coxæ. Fore wings pale fuscous with subhyaline patches as in fig. 23; basal half of the stigma almost colourless; in all the pale areas excessively minute hairs can just be seen at a magnification of $\times 60$; the hind wing is evenly hairy all over but no hairs are shown in the figure.

Head a trifle less transverse than in *thektor*, sp. n. (cf. fig. 19). Vertex rather shining and, in spite of its surface sculpture, somewhat smooth looking. Antenna with 26–29 segments. Ocell-ocular line to distance between the posterior ocelli as 5 : 2. Malar space to eye as 7 : 13.

Thorax: Collar of the pronotum with a sharp cariniform, transverse ridge at about middle; between this ridge and the posterior margin of the pronotum there is a second, somewhat feeble ridge and immediately behind the anterior margin is a third, thickened ridge (fig. 15); the collar has thus three ridges, the middle one of which is the most strongly developed; the median carina is continued along the side of the pronotum to its posterior margin; the depressed elongate area above this carina is nearly smooth. Mesonotum somewhat dull; its hairs very few in number, much fewer for example than in *numitor*, sp. n. (cf. fig. 4), arranged along each side of the notauli; within the posterior depression are two deep, but uneven sulci formed by three strong ridges, the two outer ones of which margin the inner side of the notauli posteriorly. Scutellum flattened, anteriorly with two oblique foveæ, separated by a ridge and in each of which is a single ruga which originates from the posterior side but does not reach the anterior margin and hence does not form a true costa like the median ridge. Post-scutellum with a weak, acute but not spinose projection. Propodeum: basal carina nearly half the length of the propodeum; dorsal areas weakly indicated, very shining, covered with very feeble obsolescent rugosity. Mesopleura

with only very sparse, outstanding hairs; its furrow with only fine sculpture similar to that of the medial surface of the sclerite. Fore wing (fig. 23); radius emitted from the stigma considerably beyond the middle and nearly at right angles to it. Legs: hairs of the outer side of the hind tibia a trifle longer than in *numitor*, especially on the inner side: hind tarsal segment 2 as long as 5; 3 a trifle shorter than 5.

Abdomen decidedly clavate. Tergite 1 one and one-third times longer than apically wide. Tergite (2+3) one and one-half times as wide apically as basally. Ridges of tergite 1 rather widely separated, about ten in number, on the whole very smooth and sharp, their interstices shining and faintly rugulose. Tergite (2+3) with similar sculpture but with indication of a feeble transverse area as in *hypolixi*, sp. n. (cf. fig. 24), but narrower and less well defined. Transverse furrow of tergites 4 and 5 very feeble and shallow, without a trace of a delimited basal margin as in *thestor*, sp. n.; the fine striation which crosses the furrow is extended anteriorly over the raised basal part of the segment. Sides of tergite 5 clearly convergent, the setæ very sparse (fig. 28). Declivous sides of all the exposed tergites with strong even, if somewhat confluent, sulcation. Ovipositor projecting beyond the apex of the abdomen by a distance less than half the length of the latter.

Length: 2-3 mm. without ovipositor.

CAPE PROVINCE: Pondoland, Port St. John, xi. 1923, 1 ♀, the type; 10-31. vii. 1923, 1 ♀; 5-30. iv. 1923, 1 ♀ (*R. E. Turner*).

In the patterning of the fore wings, form of the abdomen, form of the furrow of tergites 4 and 5, *inter alia*, this species closely resembles *R. hyperion*, sp. n. It differs from this species at once in having no striation on the vertex, in having the propodeum differently sculptured and the abdomen more strongly and evenly sculptured and differently coloured. The 1st abscissa of the radius of the fore wing is, in *hyperion*, inclined at more of an angle to the stigma than in *polycrates*.

Rhaconotus troilus, sp. n.

This species is extremely closely allied to *polycrates*, sp. n., but is certainly distinct from that species.

♀.—Head dark brown but faintly paler around the eyes and on each side of the vertex. Abdomen slightly redder. Legs predominantly yellowish; hind coxæ, hind femora (the latter slightly paler along the upper margin) and the callous of the femora brownish. Fore wing with only weak differentiation into light and dark areas.

Head hardly wider behind the eyes than across them, somewhat subcubical (fig. 8). Vertex somewhat dull, its sculpture finer, even, giving a beautifully beaded effect. Antenna broken but with at least 28 segments.

Pronotum more simple in form, only the middle ridge being clearly developed and then showing only as a fine raised line as in the majority of *Rhaconotus* species (fig. 14). Posterior sulci of the mesonotum less deep, the ridges forming them sharper and finer. Ridge in each of the anterior foveæ of the scutellum reaching the anterior margin so that the scutellum anteriorly appears to have a single transverse fovea with three longitudinal ridges within it. Basal carina of the propodeum very weak and not at all outstanding because of similar weak carinæ on each side of it; the propodeum is thus covered, except anteriorly, with feeble, longitudinal, somewhat wrinkly carinulæ; dorsal areas completely undefined. Mesopleura less finely sculptured, its furrow costate throughout. 2nd abscissa of the radius of the fore wing considerably shorter, only half as long as the 3rd; 1st abscissa of the radius leaving the stigma at more of an angle.

Furrow at base of tergites 4 and 5 slightly less shallow and with a trace of a delimited basal margin, the ridges ending abruptly; the surface basal to the furrow is finely striate. Ovipositor sheaths about three-quarters the length of the abdomen.

CAPE PROVINCE: Pondoland, Port St. John, 5-30. iv. 1923, 1 ♀, the type (*R. E. Turner*).

Rhaconotus iphias, sp. n.

This species closely resembles *polycrates*. The characters which separate *polycrates* from *thestor* and its allies are in the present species intensified.

♀.—Dark brown in colour, almost black to the naked eye; pale apical areas of tergites (2+3)-5 shining brown. Flagellum dark brown, faintly paler at base. Legs obscure brownish; hind coxæ and hind femora dark brown.

Fore wing only feebly marked with paler patches; about basal third of the stigma pale.

Head hardly narrower behind the eyes than across them. Vertex rather more shining than in *polycrates*. Antenna considerably longer than the body, very slender, 32-segmented. Malar space to eye as 7:15. Ocell-ocular line one and three-quarters the distance between the posterior ocelli.

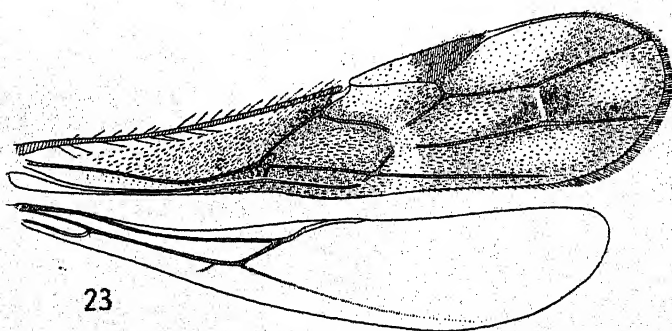
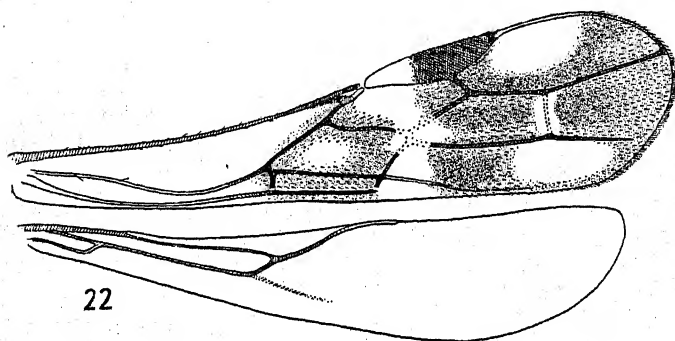


Fig. 22.—*Rhaconotus atys*, sp. n. Wings, ♀.

Fig. 23.—*Rhaconotus polycrates*, sp. n. Wings, ♀.

Thorax: Pronotal collar with only the medial ridge defined and then it is more feeble than in *polycrates*. Mesonotum more shining, posteriorly with the same three ridges but the sulci between them shallower and decidedly shining. Anterior fovea of the scutellum with three costæ. Propodeum without dorsal areas and without basal carina,

the entire dorsal surface covered with shining scaly-reticulation; posteriorly and the neighbourhood of the spiracles there are raised rugosities. Stigma emitting radius virtually at middle. Hairs of the hind tibia as in *numitor*, sp. n. (cf. fig. 16); the legs more slender, hind tarsus 2 considerably longer than 5; 3 a little longer than 5.

Abdomen: more shining than in *polycrates*, the sculpture between the ridges being more feeble. The transverse elevation of tergite (2+3) slightly better defined than in *polycrates*. Furrow at the base of tergites 4 and 5, especially of 4, clearly defined along the basal margin, the striation of tergite 4 terminating abruptly at the furrow; the surface basal to the furrow is very shining and only very weakly sculptured. Striation on declivous sides of the exposed tergites much less shining, much less strong, and less well defined than in *polycrates*. Length of ovipositor beyond the apex of the abdomen hardly shorter than the whole abdomen.

Size larger: 4 mm. without ovipositor.

E. CAPE PROVINCE: Katberg, 4000 ft., x. 1932, 1 ♀, the type (*R. E. Turner*).

Rhaconotus atys, sp. n.

♀.—Dark shining brown with reddish suffusions on head and sides of thorax; the orbits and all the surface of the head behind the eyes tends to be reddish. Apex of tergites (2+3)–5 pale. Flagellum yellowish, becoming brown on rather more than apical third. All the coxæ and femora brownish; tibiæ yellowish with a darker suffusion at apex. Fore wing brown, conspicuously and rather sharply marked with hyaline areas; hind wing almost milky white.

Head transverse, only very slightly narrower behind the eyes than across them. Face finely scaly-reticulate, becoming smooth along the middle. Frons and vertex scaly-reticulate, the meshes of the reticulation largest on vertex behind ocelli; the vertex is rather shining. Ocelli arranged in a triangle whose base is clearly longer than its sides. Ocell-ocular line three times the distance between posterior ocelli. Antenna with 31–32 segments (2 ♀♀), fine, not longer than the body. Malar space to eye as 4:5.

Thorax : Pronotum almost bare ; sides of the pronotal collar angled in front, the edge posterior to the angulation feebly emarginate (figs. 21 & 21 a) ; the pronotal collar has a single sharp, transverse ridge ; lateral areas of the pronotum with feeble scaly-reticulation. Mesonotum in profile, falling rather gradually to the pronotum, its hairs very short, very sparse and restricted to the course of the notauli ; the lobes are very shining and covered with a rather superficial scaly-reticulation ; two ridges are present posteriorly, bordering the inner side of the deep notauli and covered with the prevailing surface sculpture. Scutellum strongly convex, its two anterior foveæ each with a single ruga which originates at the posterior margin but does not reach the anterior margin. Propodeum dull on basal third to half, extremely closely and regularly reticulated ; posteriorly the sculpture becomes irregularly rugose ; no clear indication of longitudinal wrinkles such as characterize the majority of the species. Postscutellum in profile acutely pointed. Mesopleura with broken scaly-reticulation covering the disc ; the furrow deeply costate. Wings : radius of the fore wing emitted from stigma a little beyond the middle : nervus parallelus exactly interstitial (fig. 22) ; the median cell is completely bare and the other pale areas shown in the figure have excessively minute hairs visible only under a high magnification ; no hairs are shown in the figure of the hind wing, but at a magnification of $\times 60$, hairs are present all over the wing beyond the apex of the nervature ; basal to the nervature the wing appears quite bare at this magnification but at $\times 100$, minute hairs can be made out here. Legs : hind coxa with a feeble projection beneath at base ; hind tibia with extremely short ; more or less adpressed hairs on outer side (fig. 18), segment 1 of the hind tarsus twice as long as 2.

Abdomen : Tergite 1 only a little longer than apically wide, 26 : 23, its longitudinal ridges decidedly feeble, wrinkly and much broken. Tergite (2+3) basal to the furrow, sculptured exactly like tergite 1 ; apical to the furrow the ridges are sharper and more even ; these ridges extend forwards across the wide, shallow furrow to as far as the very ill-defined true suture between tergites 2 and 3. Furrow at the base of tergite 4 without a delimited basal margin, the ridges which cross it extending forwards beneath the apical margin of the preceding

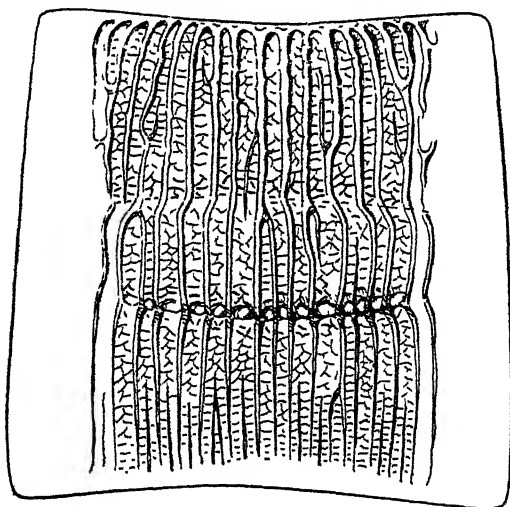
tergite. Sides of tergite 5 a little convergent, the area of the tergite apical to the furrow, transverse, its setæ, short, fine, sparse (fig. 27); the furrow itself is shallow with strong even ridges all over its apical declivity; these ridges stop short at the base of the furrow and do not extend, except in the form of hardly visible striation, over the basal declivity of the furrow. Ovipositor sheaths half as long as the abdomen.

Length: 4 mm. without ovipositor.

CAPE PROVINCE: Mossel Bay, 18. i. 1939, 1 ♀, the type; 1-2. i. 1922, 1 ♀ (*R. E. Turner*).

Rhaconotus hypolixi, sp. n.

♀.—Deep reddish brown. Propodeum almost black. Legs yellowish brown; hind coxæ and, to a less extent, the middle coxæ, much the same colour as the thorax.



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Fig. 24.—*Rhaconotus hypolixi*, sp. n. Tergite (2+3), ♀.

Head transverse, considerably narrower behind the eyes than across them (fig. 20). Face rugulose, closely scaly-reticulate between the eyes and the mandibles. Face with longitudinal, broken striations. Vertex more or less obliquely rugose-striate, the ridges running roughly

between the ocelli and the temples, but coarse and very broken, the surface between the rugæ finely sculptured; hairs of the vertex thick, setiform, more or less adpressed and directed outwards. Malar space to long axis of eye as 3 : 5. Ocell-ocular line three times the distance between the posterior ocelli. Antenna with about 40 segments; flagellum 1 as long as 2.

Thorax: Sides of the pronotum striate-rugose. Mesonotum thickly clothed with shining, setiform hairs which, on the whole, are evenly distributed over the entire surface of the lobes; (fig. 6); dull, the scaly-reticulate ground sculpture so close and uneven that the surface is describable as finely rugose; the lateral lobes show wrinkly transverse rugæ which encroach from the course of the notauli over about half the surface of the lobes; the outer margin of the lateral lobes shows similar rugosities, so that these lateral lobes in consequence have only a narrow medial strip of finely sculptured surface; all the raised rugosities of the mesonotum are overlaid with the ground sculpture. Propodeum: no trace of areation; entire surface covered with fairly close, longitudinal wrinkles which posteriorly and laterally tend to break up to form irregular striate-reticulation; the intervals between the ridges are weakly shining and show traces of an extremely feeble scaly-reticulation which spreads over the surface of the raised rugosities themselves. Metapleura not delimited, its sculpture merging imperceptibly into that of the propodeum. Mesopleura dull, sculptured everywhere; furrow well defined, indicated by a row of shallow foveæ; medial part almost granulate with indication of short, feeble ripple-like rugulosity; towards the wing insertions these rugulositys lengthen to form ill-defined longitudinal wrinkles; all the raised rugosities of the mesopleura are overlaid with the fine surface sculpture which is characteristic of the other parts of the thorax. Legs: hind coxa with a well-developed projection at base beneath; outer hairs of the hind tibiae semi-erect, about as long as the middle width of the tibiae; hind tarsal segment 1 a little less than twice 2, 9 : 5.

Abdomen: Tergite 1 as long as apically wide, a little less than half as wide at base as at apex, shining, evenly striated, the ridges and the spaces between them with fine, broken scaly-reticulation. Tergite (2+3) with a

transverse, narrowly fusiform area which is defined by a very feeble furrow basally but by a deeper furrow apically (fig. 24); the whole of the segment longitudinally striated, the ridges somewhat wrinkly at base; the ridges retain their even character on the medial area, so that this area is not at all delimited by being differently sculptured. The ridges on each side of tergite 5 converge and join along the apical margin; setæ very numerous (fig. 29).

SOUTH INDIA: Coimbatore, 9.iii.1938, 6 ♀♀, one the type, bred from *Hypolixus* sp. in *Amaranthus* (P. N. Krishna Ayyar).

This is a very distinctive species on account of the comparatively coarse sculpture of the head and thorax. And sculpture alone will distinguish it from all its African allies.

Rhaconotus signipennis (Walker).

Spathius signipennis Walker, 1860, Ann. & Mag. Nat. Hist. v. p. 309.

Spathius signipennis Walker, 1905, Szepliget, Gen. Ins. (Braconidæ), p. 53.

Stenophasmus signipennis Walker, Enderleth, 1912, Arch. für Naturges. A (2) p. 11.

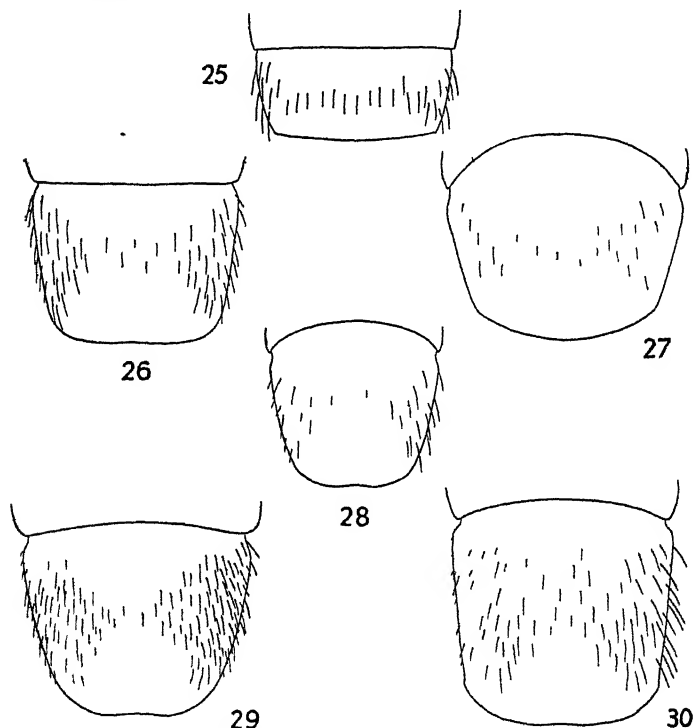
Rhaconotus signipennis Walker, Nixon, 1939, Bull. ent. Res. xxx. p. 127.

In the British Museum are two undescribed species belonging to this section of the genus; in 1939 I did not know of their existence. One is from Africa and the other from Australia. The Australian species is much less closely related to *signipennis* than is the African. Some time in the near future I hope to be able to describe them.

I stated in my 1939 paper that I considered *R. signipennis* to belong to the group of *menippus* Nixon, the only important difference lying in the arrangement of the sculptured areas of tergite (2+3). But in view of the discovery of the two undescribed species mentioned above, I now prefer to regard *signipennis* as belonging to a group distinct from that of *menippus*, though much more closely allied to it than to any other part of the genus because of the vestiture of the mesonotum and the fact that tergite 6 is always freely exposed and forms the virtual apex of the abdomen.

Rhaconotus menippus Nixon.*Rhaconotus menippus* Nixon, 1939, Bull. ent. Res. xxx. p. 123, ♀.

SOUTH INDIA: Coimbatore, bred from the following Curculionid beetles:—*Lixus* sp.; *Pempherus affinis* Fst. in jute, *Corchorus olitorius*, in cotton and in *Triumfetta rhomboidea*; *Hypolixus truncatulus* F. in the cereal *Amaranthus*.



- Fig. 25.—Tergite 5 of *Rhaconotus menippus* Nixon v. *africana* Nixon, ♀.
 Fig. 26.—Ditto of *Rhaconotus thestor*, sp. n., ♀.
 Fig. 27.—Ditto of *Rhaconotus atys*, sp. n., ♀.
 Fig. 28.—Ditto of *Rhaconotus polycrates*, sp. n., ♀.
 Fig. 29.—Ditto of *Rhaconotus hypolixi*, sp. n., ♀.
 Fig. 30.—Ditto of *Rhaconotus sulmo*, sp. n., ♀.

Rhaconotus menippus Nixon, var. *africana* Nixon.*Rhaconotus menippus* Nixon, v. *africana* Nixon, 1939, Bull. ent. Res. xxx. p. 125, ♀.

I am not altogether satisfied that these African forms to which I have given varietal status are really distinct

from typical *menippus*. More material from further Indian localities would make it easier to see if the differences I have given between *menippus* and its variety really hold good. *V. africana* evidently has a wide distribution in Africa, where it is now known to have been bred from two genera of Curculionid beetles, which feed on the sweet potato, *Ipomia batatas*. Its range is as follows :—CAPE PROVINCE : Somerset East (type series) ; Mossel Bay ; Pondoland, Port St. John. UGANDA : Kampala, ex *Peloropus batatæ* Marshall in old stems of sweet potato and ex *Cylas puncticollis* Boh. (*H. Hargreaves*). Mr. Hargreaves states that the female can live for two weeks from the times of emergence without food or water.

Rhaconotus cleanthes Nixon.

Rhaconotus cleanthes Nixon, 1939, Bull. ent. Res. xxx. p. 125, ♂♀ (s.).

The ocell-ocular line of this species is three and one-half the distance between the posterior ocelli. The malar space to the eye is as 7 : 12.

SOUTH INDIA : Coimbatore, parasite of *Pemphres affinis* Fst.

Rhaconotus mahensis Wilkinson.

Rhaconotus mahensis Wilk., 1931, Bull. ent. Res. xxii. p. 75, ♂♀.

I know this species only from the original series comprising two males and two females. It is in several respects an aberrant member of the genus and is especially so in showing virtually no trace of sculpture on the vertex.

SEYCHELLES.

**Indian and African Species of Rhaconotus
not known to the writer.*

1. *Rhaconotus roslinensis* Lal.

Rhaconotus roslinensis Lal, 1939, Indian Journal Ent. 1 (3), p. 57, ♀.

SOUTH INDIA : Coimbatore, bred from *Scirpophaga*. Apparently this species differs from *scirpophagæ* Wilkinson, a parasite of the same host, in having the stigma darkened in the middle.

* It is probable that the eight species described by Szepligeti in *Hormiopterus* (1914, Mitt. Zool. Mus. Berlin, vii. p. 201) all belong here: but they are unrecognizable from their descriptions.

2. *Rhaconotus spathulatus* Szepligeti.

Rhaconotus spathulatus Szep., 1914. Mitt zool. Mus. Berlin, vii. p. 198, ♀.

It would be almost impossible to recognize this species since the description is very vague and fails to mention diagnostic characters. It is certain, however, that Szepligeti had no true *Rhaconotus* before him for he says "Segmente 1-2 und Basis des 3. fein und dicht punktiert und matt"; a statement which could not apply to any species of *Rhaconotus*.

XXXII.—*The Crustacea, Cirripedia, of Co. Down.*

By RANALD MACDONALD.

SINCE the appearance of the fourth volume of 'The Natural History of Ireland,' by William Thompson, in the year 1856, no Irish naturalist seems to have devoted his attention to the study of the Cirripedia, or barnacles, although many of the species are of common occurrence around our coast. During the past few years, while engaged in the study of the higher Crustacea, I have devoted a fair amount of time to the collection of barnacles, and have now amassed a considerable number of species from many different localities in Northern Ireland. As Co. Down has, up to the present, received the greater share of my attention, I think that a list of the Cirripedia of this area might be of interest, not only from the point of view of the geographic distribution of species, but also to future workers in this section of the Marine Fauna of Ireland. Although Darwin, in his 'Monograph of the Sub-class Cirripedia,' records many species as Irish, in only a few cases does he give any precise localities, in spite of the fact that he was in correspondence with William Thompson while engaged in writing the 'Monograph.' Since Darwin's time, very few papers have appeared with records of Irish Cirripedia, and only one of these deals with species obtained from Co. Down since Thompson's period.

The following list of species has been compiled mainly from Thompson's 'Natural History of Ireland,' with the synonymy brought up to date, and with assistance, to

a much smaller extent, from the other works of the bibliography, as well as a number of unpublished records of my own.

LIST OF SPECIES.

Order THORACICA.

Family Scalpellidæ.

Scalpellum scalpellum (L.).

“Dredged in Belfast Bay, adhering to *Tubularia indivisa*, G. C. Hyndman and William Thompson” (*Thompson*). Groomsport (*Thompson*). In 30 fathoms, off Ardglass, Queen’s University Eastern vacation Marine Zoology course, 1939.

Family Lepadidæ.

Lepas anatifera Linn.

Belfast Bay (*Thompson*).

Conchoderma aurita (L.).

“On the bottoms of vessels from foreign localities (once or twice) in Belfast, G. C. H.” (*Thompson*).

Conchoderma virgata (Spengler).

With *C. aurita* (*Thompson*).

Family Verrucidæ.

Verruca stroemia (O. F. Muller).

“On wood floating in sea; on crabs, etc., as well as shells, Down and Antrim Coasts” (*Thompson*). On *Laminaria* stalk, Garrahan Isle, Groomsport; *Laminaria* holdfast. Ballymacormack Pt. (*R. MacD.*).

Family Chthamalidæ.

Chthamalus stellatus (Poli).

Apparently recorded by Thompson from a number of localities in Down under the name *Balanus punctatus* Montagu, which is considered by Darwin to be a synonym

of *Chthamalus stellatus* (Poli). I have visited all of Thompson's localities, but as yet I have not obtained a single specimen of *C. stellatus* (Poli), the only species which I have up till the present collected being *Balanus balanoides* (L.). As it is possible that Thompson may have been mistaken in his identification of the species, and in view of the fact that Moore & Kitching state in their paper, "The Biology of *Chthamalus stellatus* (Poli)," that the species "does not come south of the Mull of Kintyre, as far as we know," while on the map which accompanies the paper its northern limit of distribution in the Irish Sea is shown at Howth, on the coast of Co. Dublin, I shall omit all of Thompson's records pending future investigation.

Portlehan, near Ardglass (*R. MacD.*). (These specimens were obtained almost a year after the publication of the Moore and Kitching paper.)

Family Balanidæ.

Balanus porcatus da Costa.

"Dredged off Belfast Bay, Mr. Hyndman" (*Thompson*). Off Killyleagh, Strangford Loch; Ardglass Harbour and Ballymacormack Pt. (*R. MacD.*).

Balanus crenatus Bruguiere.

Belfast Bay (*Thompson*, fide *Darwin*). On *Scalpellum scalellum* (L.) from 30 fathoms off Ardglass, Queen's University Easter vacation Marine Zoology course, 1939. On *Laminaria* stalk, Ballymacormack Pt. (*R. MacD.*).

Balanus perforatus Bruguiere.

Down coast (*Hyndman*, fide *Thompson*).

Balanus hameri (Ascanius).

Belfast Bay (*Hyndman* collection, fide *Thompson*).

Balanus balanoides (L.).

Belfast and Strangford Lochs (*Thompson*). "Killinchy and Killough" (*Brown*). My own records are as follows:—Holywood, Cultra, Craigavad, Bangor, Ballymacormack Point, Groomsport, Donaghadee, Copeland Islands, Ballywalter, Ardglass, Killough and Rossglass.

Order ACROTHORACICA.

Family Peltogastridæ.

Sacculina carcini Thompson.

Often parasitic on *Carcinus mænas* (Pennant), Groomsport and Bangor (R. MacD.).

If we compare the Cirripede fauna of Down with that of the Isle of Man, we are at once aware of the following differences, as regards the species which are present in each area:—(1) The four species, *Lepas hillii* Leach, *L. pectinata* Spengler, *Balanus improvisus* Darwin, and *Galatheascus striatus* Boschama, while occurring in the Isle of Man, have not as yet been recorded from Down, although one of them, *Lepas pectinata*, has been recorded from other parts of Ireland. (2) Three species, *Conchoderma aurita* (L.), *C. virgata* (Spengler), and *Balanus perforatus* Bruguiere, which occur in the Down fauna, have not, so far ('Marine Fauna of the Isle of Man,' 1937), been recorded from Man. If we disregard the two species of *Conchoderma*, which can scarcely claim to belong to the fauna properly so called, it is apparent that Down possesses only one species, *Balanus perforatus*, which is absent from the Manx fauna, while the latter contains four as yet unrecorded from Down.

Finally, my thanks are due to Professor Flynn and to Mr. G. Williams, M.Sc., for their great kindness in allowing me to join the Easter vacation course in Marine Zoology, organised by Queen's University at Ardglass, also to Dr. J. A. Kitching for confirming my identification of *Chthamalus*, and lastly to Mr. J. G. MacWilliams for supplying me with numerous specimens from Groomsport.

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 —, & KITCHING, J. A. "The Biology of *Chthamalus stellatus* (Poli)." Journ. Mar. Biol. Ass. vol. xxiii. p. 521, 1939.
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XXXIII.—A Revision of the Malaysian Genus *Tanaëcia*
Btlr. (*Lepidoptera: Nymphalidæ*). By A. STEVEN
 CORBET, British Museum (Natural History).

[Plate VI.]

IN this revision, no attention has been paid to the specialized species, *T. cibaritis* Hew., *elone* Nic., *amisa* Gr. Sm., *calliphorus* Feld., and *trigerta* Mre., whose identification presents no difficulties.

In Malaya, all the species except *T. clathrata* and *T. cœlebs* are greyish ochreous brown above with a series of white helmet-shaped spots, bearing dark sagittate markings: in Sumatra, there is a tendency in the corresponding species for the upper surface to be a deeper, richer, purple-brown, and for the hind wing pale border to be coloured blue or violet. In Borneo, there is a high degree of individual variability, the upper side being pale greyish ochreous brown to deep purple- or chocolate-brown, the hind wing white fascia mostly blue or blue-edged and, usually, the helmet-shaped spots in spaces 2 and 3 on the fore wing above are separated from the more distal sagittate markings. In the specialized species, *T. clathrata* and *T. cœlebs*, the male is black or blackish brown above with the hind wing broadly bordered with blue or purple: the female corresponding to *T. clathrata* is deep chocolate-brown above with the usual white fasciæ. It is probably true to say that, in general, it is easier to determine the country of origin of a *Tanaëcia* specimen than to refer it to a species. In one form of *T. pelea* from Sumatra, the third joint of the palpi is rather short*, and the separation of males of *T. pelea*, *T. palguna* and *T. munda* from this island may be possible only after examination of the male genitalia: with many female specimens of *Tanaëcia*, identification can only be a matter of guess-work.

In view of the foregoing difficulties, it is hardly surprising that Fruhstorfer's monograph of the genus in Seitz, 1913, Grossschmett. Erde, ix. pp. 648-655, abounds in errors. Usually, the male genitalia serve as a reliable specific guide, but it is possible to confuse

* *T. trigerta* Mre., Java, and *T. cibaritis* New., Andaman Islands, have male genitalia exactly as in *T. pelea* Fab., but the third joint of the palpi is short and blunt. It seems probable, however, that they represent highly differentiated races of *T. pelea*.

T. pelea and *T. palguna* at a casual glance. It was found that one male of *T. munda fruhstorferi* Btlr., from British North Borneo, had the uncus considerably longer than in four other examples examined.

In three species, *Tanaëcia pelea*, *T. palguna*, and *T. cælebs*, is found a somewhat remarkable process which appears to be homologous with the gnathos*. This process has a variable number of spines (between 7 and 12 in the specimens examined), which are directed towards the uncus. The relation between the gnathos and anal opening can be clearly seen in text-figs. 7-9, which were prepared from photographs by Mr. W. H. T. Tams, and to whom I am indebted for kindly investigating the matter.

*Key for the separation of the species in the
pelea group of Tanaëcia Btlr.*

- 1 (12). Uncus sickle-shaped or straight. Underside of hind wing with two series of dark post-discal spots, both running the full length of the wing. Upper side of the fore wing with the white helmet-shaped spots in spaces 2 and 3 not separated from the sagittate submarginal markings except in Bornean races.
- 2 (7). Uncus sickle-shaped: gnathos present.
- 3 (6). ♂♀. Upperside greyish ochreous brown to rich purple-brown.
- 4 (5). Palpi third joint usually very long and fine (text-fig. 6 a). ♂. Underside of hind wing with space between post-discal black spots coloured as ground. ♀. Underside of hind wing with lunulate markings on inner edge of white post-discal band usually becoming darker towards tornus. Uncus strongly sickle-shaped, tegumen (t in text-fig. 1) nearly twice as long as uncus (u in text-fig. 1) *T. pelea*.
5. Palpi third joint shorter and blunter (text-fig. 6 c). ♂. Underside of hind wing with space between dark spots filled in with white or pale lilac helmet-shaped spots, at least in upper part of wing. ♀. Underside of hind wing with lunulate markings on inner edge of white post-band usually becoming paler towards tornus. Uncus rather weakly sickle-shaped, tegumen not much longer than uncus *T. palguna*.
6. ♂. Upper side black with broad, sky-blue border on hind wing and at ternal angle of

* Gnathos is a term invented by Pierce (1914, 'Genitalia of British Geometridæ,' p. xx), for the whole sternal plate of segment x. of the abdomen, properly called the 10th sternum (sometimes wrongly termed "sternite" or ventrite). (See also Snodgrass, 1935, 'Principles of Insect Morphology,' p. 82.)

- fore wing: underside chocolate-brown, with hind wing broadly bordered with lilac. Palpi as 5. ♂. Genitalia as 5. ♀. Unknown *T. cælebs*.
7. Uncus straight: gnathos absent. Palpi longer than in 5 and 6 (text-fig. 6, *d* & *e*)
- 8 (11). ♂♀. Upperside greyish ochreous brown to rich purple or chocolate-brown.
- 9 (10). Upper side of fore wing with white spot (which may be sullied), in space 3 separate and ovate. ♂. Upper side deep chocolate-brown. ♀. Upper side pale greyish purple-brown *T. orphne*.
10. Upper side of fore wing with the white helmet-shaped spot in space 3 conjoined with the sagittate spot in Malaya and Sumatra, but separate and with outer edge truncated in Borneo. (The Sumatran race very similar to the Sumatran race of *T. palguna*, but the Malayan race has the space between the two rows of rusty-brown lunulate markings on the underside of the hind wing filled in with white, whereas in Malayan *T. palguna* these markings are dark brown or black and the interspace is whitened only above vein 5.) *T. munda*.
11. ♂. Upper side brownish black, with markings visible but obscure and with a purple-blue border on hind wing extending to tornal angle of fore wing. ♀. Upper side deep chocolate-brown (paler in Malaya, with blue dusting at tornal angle on hind wing), with termens of both wings broadly shaded with ochreous brown *T. clathrata*.
12. Uncus distally widened, resembling a cobra's distended neck. Underside of hind wing with three series of black post-discal spots, the inner series usually not above vein 6. Upper side of fore wing with the white helmet-shaped spots in spaces 2 and 3 separated from the submarginal sagittate markings in all races. Palpi third joint long and thin, but not as fine as in *T. pelea* (text-fig. 6 *b*) *T. aruna*.

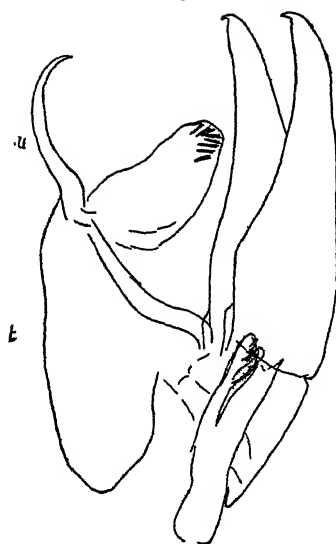
Tanaëcia pelea Fab.

Papilio pelea Fabricius, 1787, Mant. Ins. ii. p. 53; "India orientali. Dom. Lund." [Probably Malay Peninsula.]

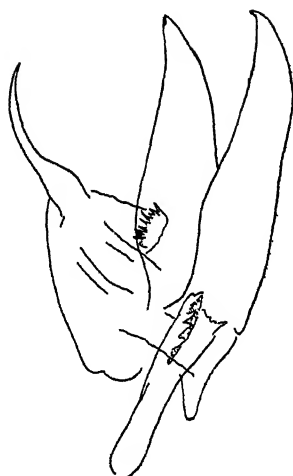
The type of *pelea* is a male in the Copenhagen Museum and cannot be distinguished from males from the Malay Peninsula.

Tanaëcia forms which have been ascertained to pertain to *T. pelea* are: *pelea* Fab. (= *pulasara* Mre., *supercilia* Btlr., *ampla* Btlr., *producta* Btlr.: the last two described from "Philippines," but the female holotypes certainly of Malayan origin), Malay Peninsula, *vikrama* Feld., Sumatra, *lutala* Mre., Borneo, *vordermani* Snell., Billiton,

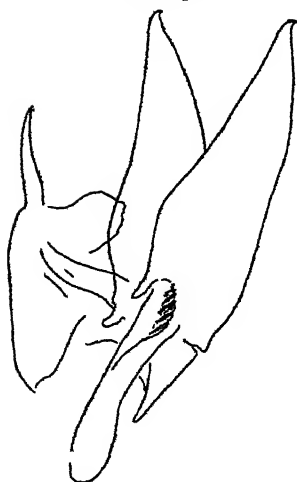
Text-fig. 1.



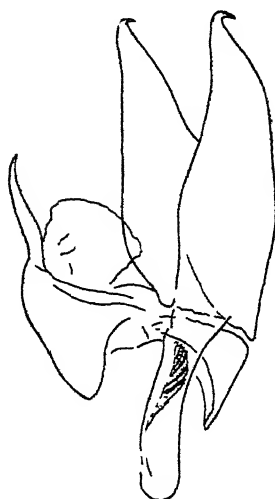
Text-fig. 2.



Text-fig. 3.



Text-fig. 4.



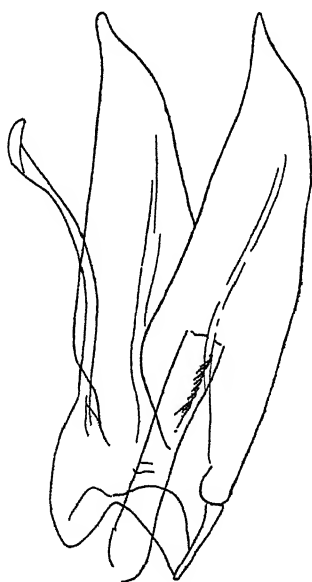
Text-figs. 1-4.

Male genitalia of (1) *Tanaëcia pelea pelea* Fab., (2) *T. palguna consanguinea* Dist., (3) *T. munda waterstradti*, subsp. n., (4) *T. clathrata violaria* Btlr. All from the Malay Peninsula.

heliophila Fruh., Nias, *suddhartha* Fruh., Batu Islands, Pulau Tello, and *dohertyi* Btlr., Sula Archipelago.

As Fruhstorfer confused *T. palguna* races with those of *T. pelea*, it is not possible to be certain that his forms *myosotina* and *dukha*, North-East Sumatra, *paryanya*, Sumatra, Pandjang, and *vikramida* and *norina*, West Sumatra, all pertain to *T. pelea*. Nor can the identity of *yasodara* Fruh., Banka, and *djataca* Fruh., Natuna Islands, be definitely established, although specimens

Text-fig. 5.



Male genitalia of *T. aruna aruna* Feld. From the Malay Peninsula. Reduced a little in comparison with (1-4), which are of the same magnification.

of *T. pelea* from Banka in the British Museum agree with the description of the first-named. As *T. palguna* has not been found in Borneo, it is probable that all Bornean forms in the *pelea* group belong to *T. pelea*: the oldest name for the Bornean race being *lutala* Mre. The form *lutala* (= *varuna* Voll.) has a pale greyish-brown upper side, f. *valmiki*s Feld. has the upper side deep purple-brown, and f. *viola* Fruh. has the white band on the hind

wing purple-washed; *lutalina* Fruh. and *chariestata* Fruh. were described from South-East Borneo and South Natuna Islands, Sirhassen, respectively. It is hardly possible to say if *rudraca* Fruh., Balabac, belongs to the *pelea* complex, as stated by Fruhstorfer. The original description and figure of *phintia* Weym., Sumatra, suggests a *pelea* rather than a *clathrata* form, but there can be no certainty regarding identification without access to the type-specimen.

Vollenhoven's figure of *varuna* (1862, Tijds. Entom. v. p. 195, pl. x. fig. 6), described from Java (type) and Borneo, is certainly not referable to *T. palguna* (the only *Tanaëcia* species known from Java), but agrees best with the female of *T. pelela lutala* Mre. from Borneo.

In Malaya, *T. pelela* occurs in a pale form (= *ampla* Btlr., *producta* Btlr.) and a dark form (= *pelea* Fab., *pulasara* Mre.), connected by an intermediate (*supercilia* Btlr.), which is rather rare. A male from Siam (Renong) agrees with the male holotype of *pulasara*. The Pulau Tioman race *irenæ* Cbt. is a much deeper purple-brown above.

Tanaëcia palguna Mre.

Adolias palguna Moore, 1857, in Horsfield & Moore, Cat. Lep. Mus. E. I. Co. i. p. 190; ♂♀, Java.

This species occurs from South Burma to Java, Bali and Lombok, but appears to be absent from Borneo. The subspecies are *consanguinea* Dist., Malaya, *superba* Btlr., Sumatra, *palguna* Mre., Java, *balina* Fruh., Bali and *stygiانا* Fruh., Lombok. A subspecies in South-east Sumatra differs from *superba* Btlr., from the north-east of the island, in the much paler ground-colour of the upper side and in the whiter fasciæ on the fore wing. I hesitate to impose a name, as it is not unlikely that it has been denominated already by Fruhstorfer as a *T. pelela* race.

A male from Victoria Point (xii. 1890, *W. Doherty*) and a male from Siam (Renong, *W. Doherty*), both ex Coll. Oberthür, differ but little from *T. palguna consanguinea* Dist. from Malaya, except in the bolder markings on the underside.

Tanaëcia cœlebs, sp. n.

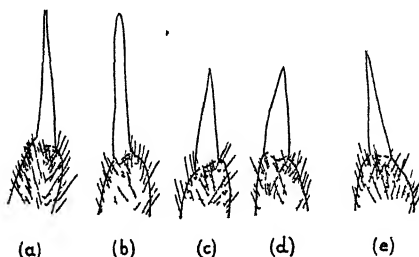
♂.—Closely resembles *T. clathrata violaria* Btlr., ♂ (= *nicévillei* Dist. Rhop. Malay. pl. xl. fig. 9), but the upper side is deep black, the markings are very obscure,

the hind wing border (which is traceable on the fore wing tornus), is clear blue and not purple-blue, and the black interneural spots, which are sagittate in spaces 5, 6 and 7, are smaller and placed much nearer the inner edge of the blue border. The hind wing is rounder and not narrowing towards the tornus so markedly as in *nicévillei*.

Underside as in *nicévillei*, except that the clearly-defined inner row of dark sagittate markings in spaces 1 b to 4 have their inner edges forming a straight line parallel to the fore wing termen, and are not elongated with the inner edges, forming an irregular curve costally bent towards the base as in *nicévillei*, and the two series of dark spots on the hind wing form regular curves parallel to the wing margin.

Fore wing 27 mm.

Text-fig. 6.



Palpi third joint of (a) *T. pelea pelea* Fab., (b) *T. aruna aruna* Feld., (c) *T. palguna consanguinea* Dist., (d) *T. clathrata violaria* Btlr., (e) *T. munda waterstradti*, subsp. n. All ♂♂ from the Malay Peninsula.

Palpi short and conical, as in *T. palguna superba* Btlr., and genitalia exactly as in *superba* Btlr. and *consanguinea* Dist.

Holotype.—SUMATRA, Btg. Proepoe, Padang Bovenland, 1600 metres, 1. iv. 1897 (*Collector D.*). In British Museum, ex Colls. van de Poll and Adams. Also examined three similar males with the same data and a male from Sumatra ex Coll. Godman-Salvin.

A male from the Malay Peninsula in Coll. Corbet differs in that, on the underside, the basal halves of the wings are paler and more ochreous, the markings in the discal

area on the fore wing are distinct and not clouded, and the space between the two series of dark lunular and sagittate markings on both wings is broader. This specimen is near the Godman-Salvin Sumatran male.

Tanaecia orphne Btlr.

Tanaecia orphne Butler, 1870, Ann. & Mag. Nat. Hist. (iv.) v. p. 362 ; ♂, Sarawak.

It may be that *orphne* Btlr., which is confined to Borneo, is specifically distinct from *T. munda* Fruh., as Fruhstorfer supposed as, in both sexes, the white, inner post-discal spots in spaces 2 and 3 on the fore wing above are oval and not outwardly truncated as in *T. munda*. Nevertheless, one male, *orphne*, closely approaches *T. munda* f. *evanescens* Btlr.

Fruhstorfer's form *pseudovalmikiis* may not be an *orphne* form, for his figure of the latter represents a form of *T. munda*.

Tanaecia munda Fruh.

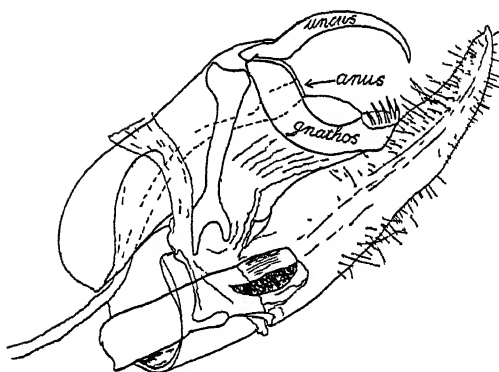
Tanaecia apsarasa munda Fruhstorfer, 1899, Berlin. ent. Z. xliv. p. 125 ; ♂♀, Borneo, Kina Balu.

The nominotypical form from Kina Balu appears to be subspecifically distinct from the smaller race *fruhstorferi* Btlr., from the rest of Borneo.

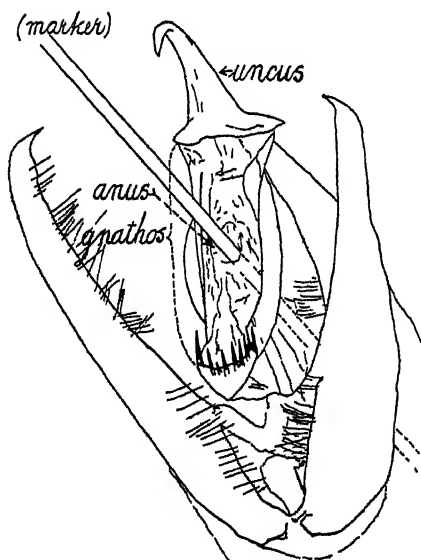
No Malayan *Tanaecia* is known to me which can be reconciled with Fruhstorfer's description of *nyagrodna*, although this might apply to a Sumatran specimen of *munda*. The species is represented in the Malay Peninsula by a form which is described below and which is superficially similar to *T. palguna consanguinea* Dist.

T. munda is rare in Sumatra, and only two males and two females (including the female allotype of *superba* Btlr.) in the British Museum can be referred to *sumatrana* Fruh., and these do not agree well with the description and figure. In Borneo, the species is common and occurs in a number of forms: f. *fruhstorferi* Btlr. (original spelling *frühstorfferi*!), resembles a small *munda*, and *albifasciata* Btlr. appears to be identical, f. *evanescens* Btlr. is a dark form with obscure markings, and f. *crowleyi* Btlr. has the upper side paler greyish ochreous brown. I should guess that *salina* Fruh. refers to the form intermediate between *evanescens* and *crowleyi*. The form *carma*

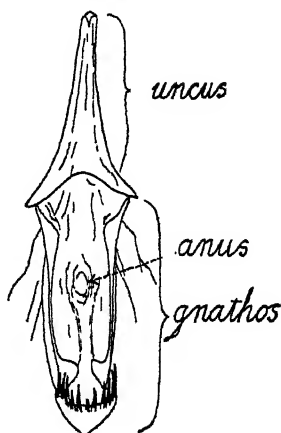
Text-fig. 7.



Text-fig. 8



Text-fig. 9



Text-figs. 7-9.

Male genitalia, showing gnathos and anus, of (7) *T. pelea pelea* Fab., Malay Peninsula, (8) and (9) *T. pelea heliophila* Fruh., Nias.

Fruh. was described from the Malay Peninsula, but Fruhstorfer's type is stated to have no locality label, and the specimens he mentioned in Seitz as being in the Adams Collection and close to *evanescens*, came from Borneo and not Malaya. Other Fruhstorfer names which can only refer to *T. munda* races, if the male genitalia are as stated by the author, are *bungurana*, Natuna Islands, *manavira*, Pulau Laut, and *niricvara*, Batu Islands.

***Tanaëcia munda waterstradti*, subsp. n.**

♂.—Wing-shape closely resembles that of *T. palunga consanguinea* Dist., ♂, but the wings are more ample and the hind wing does not narrow so sharply towards the tornus. The third joint of the palpi longer and finer than in Distant's form.

Upper side very similar to *consanguinea* ♂, except that the dark post-discal sagittate markings are longer and more acute and extend further into the white helmet-shaped spots, which latter are longer than in *consanguinea*. On the hind wing, the whitening in the distal half extends further towards the anal angle.

Underside differs from *consanguinea* in that the inner and outer edges of the hind wing post-discal band are indicated by rather diffuse brown markings (inner series lunulate and outer series sagittate), and not by heavy black arrows as in *consanguinea*, and the pale lilac colouring covering the hind wing post-discal band is more extensive in three of the four males examined. The distal half of both wings is usually laved with lilac-white to the termens.

Fore wing 30 mm. Genitalia as in other *T. munda* races.

Holotype.—MALAKKA, 1904 (*J. Waterstradt*), ex Coll. Oberthür. Also examined males from Perak (*W. Doherty*), Pahang (Kuala Teku, 28. vi. 1905 and 1. viii. 1905, *H. C. Robinson*), and Selangor (3. iii. 1907, *E. W. Wickham*).

♀.—Very similar to *consanguinea* Dist. ♀, but, judging by three Malayan ♀♀ of each species before me, which I believe to be correctly determined, the differences are as follows:—In *waterstradti*, the palpi third joint slightly longer and finer, the termen of the fore wing straighter and the apex only slightly falcate. On the upper side, the white fasciæ are clearer white and not as sullied, the dark sagittate markings are not as sharply pointed or defined and particularly on the hind wing, are somewhat farther

removed from the termen, thus making the white fasciæ appear narrower. On the underside, the sagittate markings are rather farther from the termen as above, and the lunules on the inner edge of the white fasciæ may be slightly broader and more diffuse, although there is much less dark dusting between the cell-end spot and the white fascia in spaces 4-6 on the fore wing.

Fore wing 36 mm.

Allotype.—MALAKKA, 1904 (*J. Waterstradt*), ex Coll. Oberthür. Other females examined from Perak and Selangor.

Tanaëcia munda manata, subsp. n.

Euthalia pelea Evans (*nec.* Fabricius), 1932, Ident. Ind. Butt. p. 151.

♂.—Very similar to *T. pelea pelea* Fab. f. *pelea* ♂, from Malaya, the hind wings rounded as in that species, but the third joint of the palpi short and conical as in races of *T. munda*, and the fore wing apex is not produced.

Upper side differs from *pelea* only in that the blackish-brown sagittate submarginal markings are smaller and finer.

On the underside, the ground-colour in the basal halves of the wings deeper ochreous brown than in *pelea*, and the spaces between the black markings slightly darker than the ground. The space between the post-discal rows of black markings in the upper half of the hind wing are filled in with faint lilac-white.

Fore wing 22.5 mm.

Holotype.—BURMA, Mergui, ii. 1922 (*G. E. R. Cooper*). Also examined a similar male from Mergui (Lenya Valley, ii. 1922 (*G. E. R. Cooper*).

Tanaëcia clathrata Voll.

Adolias clathrata Vollenhoven, 1862, Tijds. Entom. v. p. 205, pl. xii. fig. 5; ♂, Borneo.

The female holotype of *violaria* Btlr., from Singapore, was placed under *T. pelea* by Fruhstorfer in Seitz, but there can be little doubt that it is the hitherto unknown female of *nicévillei* Dist., described from Perak. The female of *violaria* is larger than the female of *T. munda waterstradti*, deeper purple-brown above, with the tornal half of the white post-discal band purple-washed and, on the underside, the outer 2-3 mm. of the fore wing and hind wing termens is shaded with deep ochreous brown,

while the inner edge of the white fasciæ is broadly shaded with the same colour. In the male form *subclathrata* Stgr., the black spotting on the hind wing band is obsolete.

A male from Sumatra, Bila, resembles the Malayan race except for the much darker underside. I have seen no examples of nominotypical *clathrata* Voll. from South Borneo, but it may hardly differ from *cærulescens* Gr. Sm. (= *ellida* Stgr., *purpurea* Fruh.), North Borneo. Three Bornean females are deeper and darker brown above than in *violaria*, and they have no blue on the hind wing.

Tanaëcia aruna Feld.

Adolias aruna C. & R. Felder, 1860, Wien. ent. Mon. iv. p. 400; Malay Peninsula.

Usually, there is no difficulty in recognizing this species on account of the three post-discal rows of spots on the hind wing beneath. Fruhstorfer correctly separated the species, and there is little or no doubt that his *T. aruna* forms actually refer to this species.

The subspecies are *aruna* Feld. (= *robertsii* Btlr., *satapana* Fruh.), Malaya, *martigena* Weym. (= *watsoni* Btlr.), North-East Sumatra, *pratyeka* Fruh., West Sumatra, Padang Bovenland, *namarupa* Fruh., Banka, *sramanas* Fruh., Batu Islands, *triratna* Fruh., Natuna Islands, **pardalis* Voll. (= *apsarasa* Voll., *subochrea* Btlr., *margarita* Btlr.), Borneo, and *palawana* Stgr., Palawan.

The ♂ form *satapana*, described by Fruhstorfer as "adorned with blue-violet, somewhat like *martigena* Weym. from Sumatra," is not known to me from the type-locality of the Malay Peninsula. In Borneo, the form with lilac laved hind wing is referable to *apsarasa* Voll., while the other Bornean names refer to the form not so coloured.

FIGURES IN SEITZ AND DISTANT.

My interpretation of the figures of *Tanaëcia* forms in Seitz, Grossschmett. Erde, ix., and in Distant, Rhop. Malay., are as follows:—

SEITZ :

T. pelea forms : pl. cxxxiii. a 5, *lutala* ♂ (nec ♀), b 1, *lutala* f. *valmikiis* ♀, b 4, *vikrama* ♂; pl. cxxxii. a 1, *heliophila* ♂.

* Erroneously described from Java, where *T. aruna* does not occur.

T. palguna form: pl. cxxxi. e 3, *stygiana* ♂.

T. munda forms: pl. cxxxiii. a 6, *munda* ? f. *salina* ♂, b 3, *fruhstorferi* f. *evanescens* ♀, c 3, *munda* Fruh. ♂, d 4, *fruhstorferi* f. *fruhstorferi* ♂.

T. clathrata forms: pl. cxxxiii. d 2 & d 3, *clathrata* ♂.

T. aruna forms: pl. cxxxiii. c 1, *martigena* ♀ (in spite of Fruhstorfer's remarks), c 4, *martigena* ♂, d 5, *pardalis* f. *pardalis* ♀.

The figure on pl. cxxxiii., c 2, appears to me to agree best with *T. palguna* Mre. ♂, from South-East Sumatra.

DISTANT :

Pl. xiv. fig. 13, *T. pelea pelea* Fab., ♀.

Pl. xv. fig. 7, *T. aruna aruna* Feld., ♂.

Pl. xv. fig. 8, *T. pelea pelea* Fab., ♂.

Pl. xv. fig. 9, *T. clathrata violaria* Btlr., ♀.

Pl. xviii. fig. 9, *T. pelea pelea* Fab., ♀.

Pl. xix. fig. 6, *T. pelea pelea* Fab., ♂.

Pl. xl. fig. 9, *T. clathrata violaria* Btlr., ♂.

Pl. xliii. fig. 4, *T. palguna consanguinea* Dist., ♂.

The types of the following *Tanaëcia* have been examined in the British Museum :—*albifasciata* Btlr., *ampla* Btlr., *cærulescens* Gr. Sm., *crowleyi* Btlr., *dohertyi* Btlr., *evanescens* Btlr., *fruhstorferi* Btlr., *lutala* Mre., *margarita* Btlr., *orphne* Btlr., *palguna* Mre., *producta* Btlr., *pulasara* Mre., *robertsii* Btlr., *siddhartha* Fruh., *subochrea* Btlr., *superba* Btlr., *supercilia* Btlr., *violaria* Btlr., and *watsoni* Btlr. In the Copenhagen Museum :—*pelea* Fab. In the Collection of A. Hall, Esq. :—*heliophila* Fruh.

EXPLANATION OF PLATE VI.

All males.

Fig. 1. *Tanaëcia pelea pelea* Fab., Malaya, Perak.

Fig. 2. *Tanaëcia pelea vikrama* Feld., Sumatra, Deli.

Fig. 3. *Tanaëcia pelea lutala* Mre., Borneo, Kina Balu.

Fig. 4. *Tanaëcia palguna consanguinea* Dist., Burma, Victoria Point.

Fig. 5. *Tanaëcia palguna consanguinea* Dist., Malaya, Perak.

Fig. 6. *Tanaëcia palguna superba* Btlr., Sumatra, Padang Sidempoean.

Fig. 7. *Tanaëcia palguna palguna* Mre., Java, Mt. Gede.

Fig. 8. *Tanaëcia munda manata*, subsp. n., Burma, Mergui (*Holotype*).

Fig. 9. *Tanaëcia munda waterstradti*, subsp. n., Malaya.

Fig. 10. *Tanaëcia munda fruhstorferi* Btlr., British North Borneo.

Fig. 11. *Tanaëcia aruna aruna* Feld., Malaya.

Fig. 12. *Tanaëcia aruna martigena* Weym., Sumatra, Deli.

Fig. 13. *Tanaëcia aruna pardalis* Voll., South-east Borneo.

Key to Plate.

1	5	9	12
2	6	10	13
3		11	14

XXXIV.—*Notes on British Psocoptera*.—I. *Elipsocus hyalinus* (Steph.), and its Allies. By D. E. KIMMINS (Department of Entomology, British Museum (Natural History)).

THREE species in this group have been recorded from Britain, *E. hyalinus* (Steph.), *E. westwoodi* McL. and *E. abietis* Kolbe. In the hope of discovering Jentsch's species, *E. pallidus**, a fairly intensive collection of *Elipsocus* was made during the autumn of 1940, but without success. Two species only of this genus were taken which, according to Enderlein's key in the 'Tierwelt Mitteleuropas,' appeared to be *westwoodi* and *abietis*. The latter species is supposed to be more or less restricted to conifers, but my specimens of the latter were taken, together with *westwoodi*, chiefly on apple and elder. This seemed rather curious, and I decided to refer to the original descriptions of the three species.

Stephens' account of *hyalinus* is as follows:—"Sp. 23. *hyalinus*. *Fusco-piceus, pedibus pallidioribus, abdominis basi ochracea flavâ, alis hyalinis, limpidis, stigmatibus fusco*. (Long. corp. 1 lin.; Exp. Alar. 3 lin.)

"Ps. *hyalinus*. Steph. Catal. 313. No. 3508.

"Head pitchy-brown, clypeus and mouth paler; eyes black; thorax pitchy-red; immaculate; abdomen above pitchy-brown, with the base ochreous-yellow, beneath pale pitchy-red; limpid, nervures and stigma fuscous; antennæ short, pitchy-brown, palest at the base.

"Taken in June, near London."

* Jentsch, 1933, Abh. Gestfâl. Prov. Mus. Naturk, ix, p. 27.

It will be noted that he describes the abdomen as pitchy-brown, with the base ochreous-yellow, while Enderlein says the abdomen is pale yellow; further, Stephens does not mention the fuscous shading of the *areola postica* of the fore wing. Examination of Stephens type confirmed the accuracy of his description, and it soon became obvious that the *hyalinus* of Stephens was different from the form given that name by Enderlein and other authors. The error would appear to have arisen in McLachlan's monograph of the British Psocidæ (1867); his description was apparently based on mis-identified material in his own collection, and not on Stephens' specimen. McLachlan's is certainly the first work I have seen which attributes to *hyalinus* a pale yellow abdomen, tipped with fuscous, and a fuscous cloud over the free marginal cellule (*areola postica*) in the fore wing. Subsequent authors have accepted without question his conception of *hyalinus*, and this has unfortunately led Kolbe to re-describe Stephens' species under the name *abietis*, his account, in fact, being a very good description of *hyalinus*. He believed that it occurred chiefly on *Abies*, but actually it is to be found on many deciduous trees and bushes, as well as on conifers.

The question next arises as to the identity of *Elipsocus hyalinus* of McLachlan and subsequent authors. I have as yet failed to take this yellow-bodied species, but I have examined specimens in the British Museum and other collections, including some from McLachlan's collection, and it is undoubtedly distinct, although related to *westwoodi*. Jentsch has recorded that the nymph also has the pale yellow abdomen, which distinguishes it readily from *westwoodi*. In the adult ♀, in addition to the yellowish abdomen, the wing markings are more sharply defined, and the apex of the anterior wing is blunter, being semicircular rather than elliptical. This species will therefore require to be re-named; the only possible name available is *E. brevistylus* Reuter, of which Enderlein (1903) says that the male is almost certainly identical with that of *hyalinus*. I have not seen an authentic example of Reuter's species, and as the males of *Elipsocus* are much more difficult to separate specifically than females, it seems preferable to propose a new name for *Elipsocus hyalinus* McLachlan.

The difficulty of determining the males of *Elipsocus* has just been mentioned. In the case of *westwoodi* and *hyalinus*, I suspect that all the males I have taken belong to one species. The male genital structures appear to be the same in all I examined, the pattern of the head proved somewhat variable and less defined than in the females, and the wings are practically devoid of pattern. A venational character (the position of the fork of the radial sector in relation to M_2 and M_3) which is fairly constant in the females indicates that all the males examined so far (apart from the yellow-bodied forms) belong to *westwoodi*.

We are thus faced with two possibilities :—

(i.) That *hyalinus* and *westwoodi* females are dimorphic forms of one species ; or

(ii.) that the males of *hyalinus* are very scarce and that the species normally reproduces parthenogenetically. The first supposition is not tenable, since the two females develop from nymphs which are easily separable. We are therefore left with the possibility of the *hyalinus* females being parthenogenetic ; the only evidence in favour of this is that females bred from nymphs in captivity laid eggs freely on twigs covered with *Pleurococcus* *.

E. westwoodi and the true *hyalinus* are often found together. Indeed, in McLachlan's collection, his series of *westwoodi* consisted of both species. In one locality, which I worked over a period of three months (July to September), the proportions of the two species varied. At first, judging by the females, *westwoodi* appeared to predominate and on one occasion *hyalinus* was entirely absent, but later (towards the end of September), *hyalinus* was becoming the dominant species. *E. hyalinus* appears to carry on later in the year than *westwoodi*, as I have taken specimens towards the end of October and even as late as the beginning of December, after two or three sharp frosts. *E. westwoodi* does not seem to have been recorded later than October.

Elipsocus hyalinus (Stephens), 1836. (Figs. 1 & 2.)

Psocus hyalinus Stephens, 1836, Ill. Brit. Ent., Mand. vi. p. 123.

Psocus bipunctatus Stephens, 1836, Ill. Brit. Ent., Mand. vi. p. 123.

? *Psocus hyalinus* Steph., Hagen, 1861, Ent. Ann. p. 26.

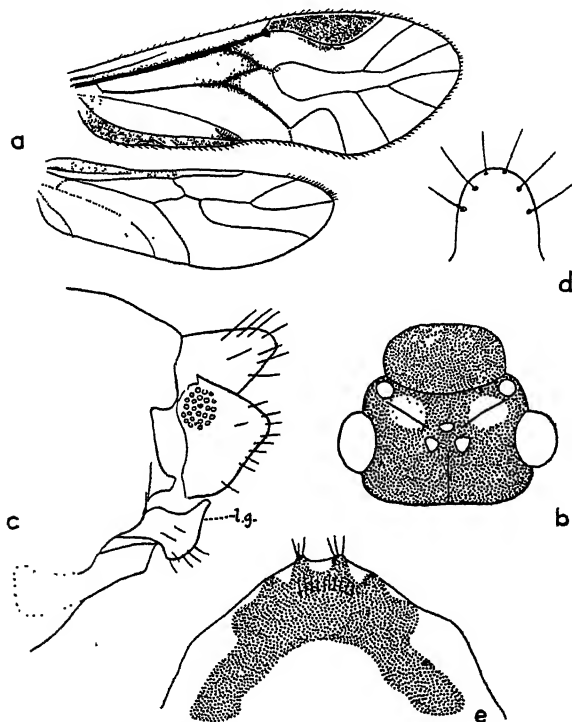
* These eggs proved to be fertile, and hatched in the spring of 1941.

Elipsocus westwoodi McLachlan, 1867 (partim), Ent. Mon. Mag. iii. p. 274.

Elipsocus abietis Kolbe, 1880, J. Ber. Westfäl. Prov. Ver. viii. p. 114, fig. 8 (syn. nov.).

♀.—Head generally uniform dark brown, often with a pair of paler spots on face, above antennal bases ;

Fig. 1.



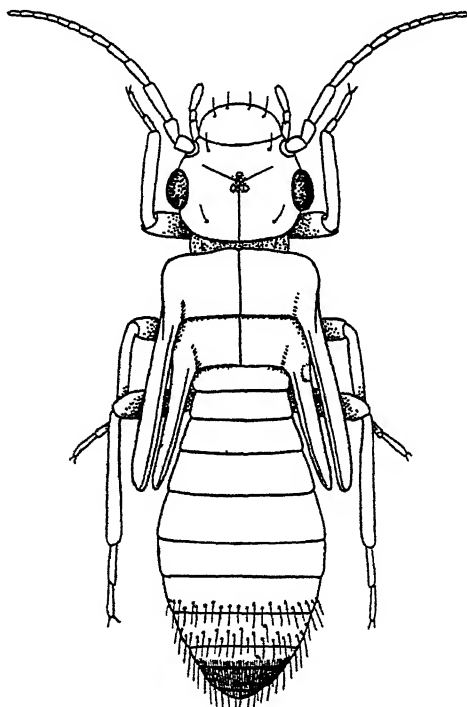
Elipsocus hyalinus (Steph.), ♀.

a, wings ; b, pattern of head ; c, apex of abdomen from side, l.g., lateral gonopod ; d, tenth tergite, dorsal ; e, pattern of subgenital plate.

genæ fuscous. Antennal segments dark grey brown. Meso- and metathorax dark brown, mesoscutellum rather paler, but not conspicuous. Legs dark greyish brown. Abdomen whitish yellow, shaded with reddish on tergites four to six, and to a lesser degree on the centre of tergites.

two to three, basal segment and apex of abdomen (except tenth tergite) fuscous. Ventral surface of abdomen generally lightly shaded with reddish at sides; subgenital plate dark brown, clearly-defined apical margin with acute excisions on each side of the rather narrow, central excision. Tenth tergite with usually six strong marginal setæ.

Fig. 2.



Elipsocus hyalinus (Steph.). Last instar nymph.

Fore wing hyaline, pterostigma darkly pigmented throughout its length, pigmentation extending below R_1 . Median smoky patchy rather diffuse, not extending much into cubital cell. No fuscous area over apex of areola postica, which is rounded above. Fork of radial sector generally situated between the origins of M_2 and M_{3+4} . Apical margin of wing acutely rounded.

♂ (not yet recognized).

Length of fore wing.—♀, 2·7–3·2 mm.

Distribution.—ENGLAND: Somerset, Dorset, Hants, Sussex, Kent, Surrey, Bucks., Suffolk, Notts., Derby, Lancs. SCOTLAND: Dumfries, Lanark, Edinburgh, Kincardine, Arran. IRELAND: Dublin, Wicklow, Westmeath, Mayo, Galway.

Habitat.—Trunks and branches of conifers and deciduous trees and bushes, including pine, larch, yew, juniper, chestnut, willow, oak, apple, elder, hawthorn and bracken (*Pteris*).

Records of the appearance of the adult cover the months of April to the beginning of December. This long period rather suggests that there may be more than one generation annually.

Nymph (fig. 2).—Resembling the adult in form but flatter, thorax less humped. Head a little broader than long, abdomen scarcely wider than mesothorax. Abdomen yellowish white, tergites five to seven pale pitchy-red, segments nine to ten piceous, seven to nine with numerous long black setæ, remaining setæ with only short inconspicuous setæ. These long black setæ form a useful character with which to separate *hyalinus* nymphs from those of *westwoodi*.

Elipsocus westwoodi McLachlan, 1867. (Figs. 3 & 4.)

Psocus quadrimaculatus Westwood, 1840, Intro. Mod. Class. Ins. ii. p. 19, fig. 59; Hagen, 1861, Ent. Ann. p. 24.

Elipsocus westwoodi McLachlan, 1867 (partim), Ent. Mon. Mag. iii. p. 274; Rostock, 1887, J. Ber. Naturk. Zwickau, p. 170; Enderlein, 1903, Zool. Jahrb. lxxx. pp. 378–9, pl. xix. fig. 12; Enderlein, 1927, Tierwelt Mitteleuropas, vii. p. 10, fig. 21.

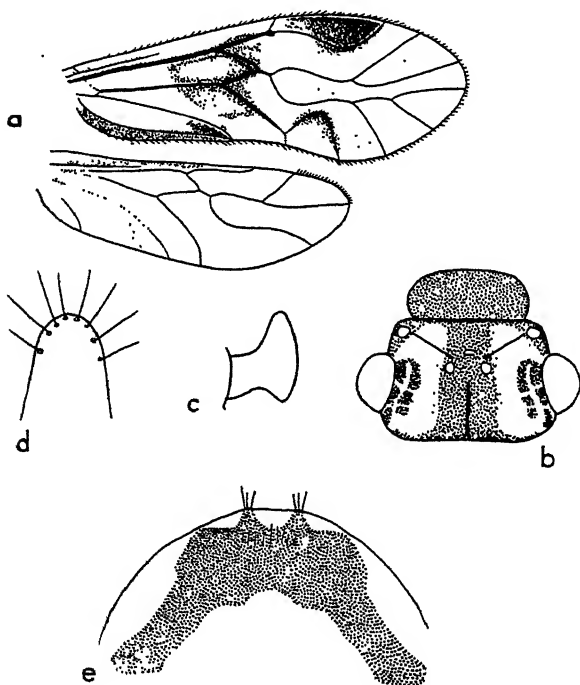
Elipsocus moebiusi Tetens, 1891, Ent. Nachr. pp. 372, 379.

♀.—Head with a dark brown median band passing from over ocelli to clypeus, margined on each side with a yellowish band. On the vertex near each eye is a cluster of dark brown spots, the narrow pale lines separating them giving a reticulated appearance. Genæ yellowish. Antennæ greyish-brown. Meso- and metathorax dark brown, the scutellum of each light yellowish, rather conspicuous. Legs greyish brown. Abdomen whitish, with extensive purplish-red markings covering most of tergites three to six, and basal half of seven, two to three with a dark spot on their common margins. Basal segment and apex of abdomen (except tenth tergite) fuscous. Beneath

much as in *hyalinus*, but darker; subgenital plate dark and distinct, median apical excision wide, bordered on each side by an obtuse excision. Tenth tergite usually with eight strong marginal setæ.

Fore wing hyaline, often somewhat greyish, pterostigma darkly pigmented in its apical two-thirds, pigment

Fig. 3.

*Elipsocus westwoodi* McL., ♀.

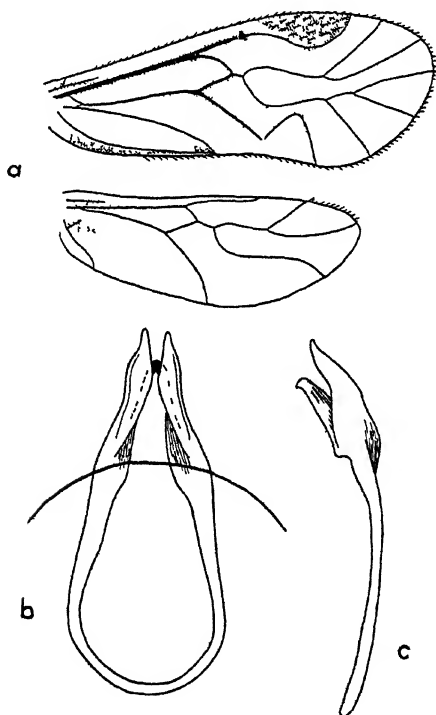
a, wings; b, pattern of head; c, lateral gonopod;
d, tenth tergite, dorsal; e, pattern of subgenital plate.

extending below R_1 . Median smoky patch larger and stronger than in *hyalinus*, extending further basally, and also downwards across the cubital cell to the analis, often with a paler area in the radial cell. Areola postica with distinct fuscous shading over apex. Fork of radial

sector generally at level of M_{3+4} or only slightly beyond. Apex of wing acutely rounded.

♂.—Rather larger than ♀. Head dark brown, a slightly paler vertical band on either side of ocelli; eyes, as is

Fig. 4.



Elipsocus westwoodi McL., ♂.

a, wings; b, phallic sclerite, ventral; c, the same, lateral.

usual in males, larger and more prominent. Genæ slightly paler than general head colour, but darker than ♀. Antennæ greyish brown. Meso- and metathorax dark brown, mesoscutellum pale but less conspicuous than in female. Legs greyish brown. Abdomen largely whitish, sometimes with light reddish brown suffusion, basal and

apical segments dark brown. Phallic sclerites visible from beneath through the integument, tapering towards apex, but the degree of approximation probably differing in individuals.

Length of fore wing : ♀ 2·7–3·2 mm., ♂ 2·9–3·3 mm.

Distribution.—ENGLAND : Devon, Somerset, Wilts., Hants, Sussex, Kent, Surrey, Herts., Oxon., Norfolk, Cambs., Notts., Derby, Westmorland. WALES : Merioneth. SCOTLAND : Ayr, Renfrew, Lanark, Selkirk, Edinburgh, Fife, Stirling, Perth, Kincardine, Aberdeen, Elgin, Argyll, Arran, Shetlands. IRELAND : Dublin, Wexford, Westmeath, Roscommon, Mayo, Galway, Waterford, Cork, Kerry.

Habitat.—Trunks and branches of conifers and deciduous trees and bushes, including pine, spruce, larch, juniper, yew, sycamore, hazel, hawthorn, oak, apple and elder.

This species has been recorded as occurring during the months of May to October, with one record for March. As in *hyalinus*, there are possibly two generations annually, overlapping each other.

Nymph.—Similar to *hyalinus*, but readily distinguished by its stouter build, its abdomen noticeably wider than mesothorax, and the absence of long black setæ on abdominal segments seven to nine. Segments nine to ten are not so dark as in *hyalinus*, and the head is comparatively broader.

Elipsocus mclachlani, sp. nov. (Fig. 5.)

Elipsocus hyalinus McLachlan (nec Stephens), 1867, Ent. Mon. Mag. iii. p. 275 ; Kolbe, 1880, J. Ber. Westfäl. Prov. Ver. viii. p. 114, fig. 7 ; Enderlein, 1903, Zool. Jahr. lxxx. pp. 377–8, pl. xix. figs. 14–15 ; Enderlein, 1927, Tierwelt Mitteleuropas, vii. p. 11, figs. 22–23.

? *Elipsocus brevistylus* Reuter, 1894, Acta Soc. Fauna Flor. Fenn. ix. p. 44, fig. 6 (♂).

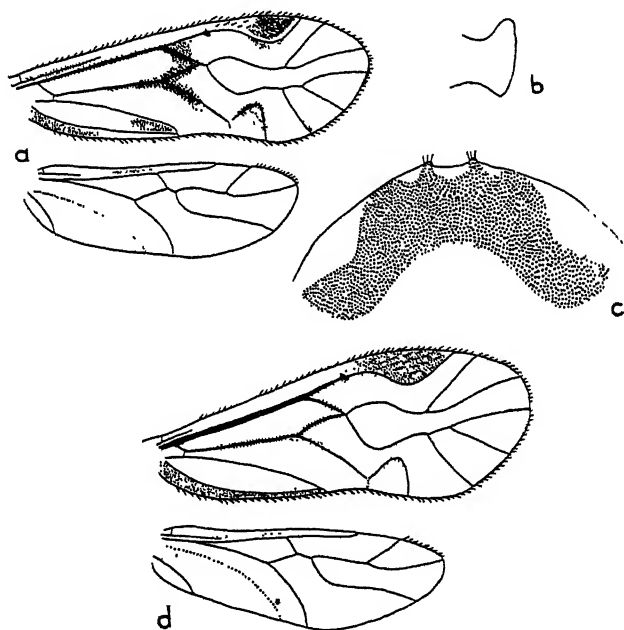
? *Elipsocus hyalinus* var. *abdominalis* Reuter, 1904, Acta Soc. Faun. Flor. Fenn. xxvi. (9) p. 6.

♀ (dried). Smaller than *hyalinus* or *westwoodi*.—Head rather as in *westwoodi* but duller, markings less distinct, genæ brownish. Meso- and metathorax brownish, legs similar. Abdomen pale yellowish with base and apex brown. In two females (in fluid) from Mr. J. V. Pearman's collection, the abdomen is not entirely pale, but there are indications of reddish transverse bands on tergites six to eight. and the lateral margins of the sternites are

reddish, leaving a pale median stripe. Subgenital plate rather as in *westwoodi*, but lateral shoulders more rounded.

Fore wing hyaline, pterostigma darkly pigmented in its apical half. Median smoky band more sharply defined than in *hyalinus* or *westwoodi*, forming a zig-zag over *R*, *M*, *Cu*. A fuscous patch over the areola postica, which is smaller and more angled. Apex of wing rather bluntly rounded. Fork of radial sector at level of M_{3+4} .

Fig. 5.



Elipsocus mclachlani, sp. n. a-c, ♀; d, ♂.

a, wings; b, lateral gonopod; c, pattern of subgenital plate;
d, ♂ wings.

♂ similar to *westwoodi*, but smaller and with blunter wing; areola postica and fork of radial sector as in ♀; abdomen pale yellowish as in ♀.

Length of fore wing: ♀ 2.2–2.7 mm., ♂ 2.6–2.8 mm.

Type ♀ (microscope preparation).—Somerset, Clevedon, 7. vii. 05, oak trunks (*E. Saunders*), in British Museum,

Nat. Hist. collection; paratypes ♂♀ from various localities in the collections of the British Museum and Mr. J. V. Pearman.

Distribution.—ENGLAND: Devon, Somerset, Kent, Surrey, Norfolk, Cambs., Lancs. WALES: Merioneth. SCOTLAND: Lanark, Edinburgh, Stirling, Perth, Aberdeen, Inverness. IRELAND: Dublin, Westmeath, Kerry.

Habitat.—Fir, oak trunks, chestnut, on rocks, in gall of *Saperda populnea*.

The time of appearance of the adult is the months of July to September, with a single record for November. It seems to be scarcer than either *hyalinus* or *westwoodi*, and I have seen few examples. Pearman says that it has only one generation annually.

I have not seen the nymph, but Jentsch records that the abdomen is yellowish as in the adult.

XXXV.—*Descriptions and Records of Mallophaga from the Pacific Islands.* By GORDON B. THOMPSON.

[Plate VII.]

Dennysus francicus, sp. n. (Pl. VII. figs. 1 & 2;
and text-fig. 1 a.)

Type-host.—According to the original label the host of this species is *Collocalia francica* (Gmelin) (Grey Martin). On referring to Mathews' 'Systema Avium Australasinarum' it seems probable that the correct name for the bird is *Collocalia francica reichenowi* Stres.

Specimens examined.—♀ holotype, ♂ allotype, and 4 ♀♀ paratypes from the type-host, British Solomon Islands, Malaupaina, Three Sisters, 12. v. 1934.

A detailed description is not necessary for this new species, since it is very closely related to *Dennysus distinctus* Ferris (1916). The main differences are as follows:—a very much darker species, short and broad with the head shorter and more tapering. The supra-antennal margins are bulging (see text-fig. 1 a). The thorn-like setæ situated on the paratergites are almost lacking.

Length: ♀ 1.9 mm., ♂ 1.6 mm.; greatest breadth: ♀ 0.7 mm., ♂ 0.6 mm.

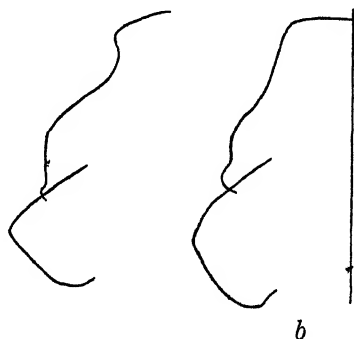
Dennyrus distinctus Ferris (1916).

Previous records.—*Collocalia* sp., Java, Samarang; *Collocalia ocista* Oberhosler, Marquesas Is., Uahuka, Vaipae Valley.

New Record.—*Collocalia* sp., New Hebrides.

The specimens here recorded have not been compared with the type, but as they agree fairly well with Ferris's

Text-fig. 1.



- a. Outline of left side of head of *Dennyrus francicus*, sp. n. ♂.
b. Outline of left side of head of *D. distinctus* Ferris. ♂.

description and figures I have no hesitation in determining them as *D. distinctus* Ferris.

The specimen from which the outline figure of the head is drawn is one of a series taken from an undetermined host in Java. The specimens agree perfectly with Ferris's description and figures.

Eureum mumfordi, sp. n.

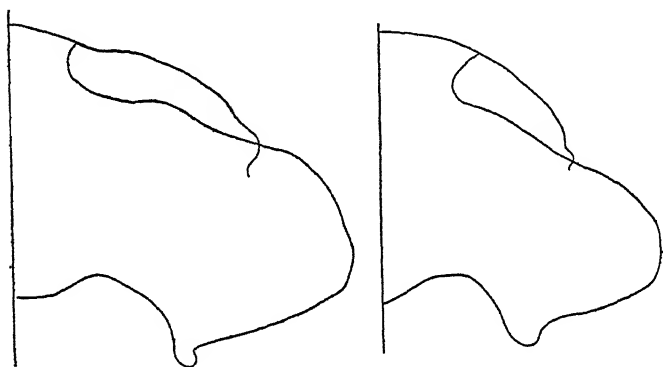
Type-host.—*Collocalia* sp.

It is a great pity that the host of this new species cannot be given in full. Unfortunately there are so many species and subspecies of *Collocalia* recorded from the New Hebrides that it would be unsafe even to suggest the actual host-species. It is very possible that this parasite will be found to parasitize numerous species of *Collocalia*.

Specimens examined.—♀ holotype and 1 ♀ paratype.

Up to the present only a single species of the interesting genus *Eureum* is known. The type-host of *Eureum cimicoides* Nitzsch, the genotype and sole species, is *Micropus apus apus* (L.), the European Swift. This large parasite is by no means common. The single female in my collection, with which I have compared this new species, is one of a small series which I have seen at various

Text-fig. 2.



- a. Outline of right side of head of *Eureum cimicoides* Nitzsch. ♀.
b. Outline of right side of head of *E. mumfordi*, sp. n. ♀.

times. I have never seen the male, and it seems that the males are very rare.

Eureum cimicoides Nitzsch.

Length 3.8 mm.: greatest breadth: 2.3 mm.

Head (see text-fig. 2 a).—Rather more than twice as long as broad. Antennal fossæ elongate and rather shallow. Posterior margin of temples produced into small lobes. Gular plate indistinct. Gular bars each bearing about four stout setæ.

Eureum mumfordi, sp. n.

Length 3.4 mm.; greatest breadth: 1.6 mm.

Head (see text-fig. 2 b).—Almost exactly twice as broad as long. Antennal fossæ short and deep. Posterior margin of temples produced into two large, evenly rounded lobes. Gular plate very distinct. Gular bars each bearing about nine fairly stout setæ.

Prothorax and meso-metathorax very similar in the two species.

Prothoracic sternite not very well marked and bearing a number of short setæ anteriorly and three pairs of rather longer setæ medially to about half the length of the sternite.

Prothoracic sternite very well marked and bearing about sixteen short peg-like setæ anteriorly and down a median line.

Legs very similar in both the species.

Abdomen with distinct patches of setæ on the 5th-7th ventral abdominal segments.

Abdomen with distinct patches of setæ on the 6th and 7th ventral abdominal segments, with an indistinct patch consisting of fewer setæ on the 5th.

Terminal abdominal segments (See text-fig. 3 a.)

Terminal abdominal segments. (See text-fig. 3 b.)

Trichodectes canis (De Geer).

New record.—Males and females from a dog, New Britain, Kieta district, 16. x. 1937 (*J. L. Froggatt*).

Degeeriella rhipidura, sp. n.

Type-host.—*Rhipidura leucophrys melaleuca* (G. and G.) (Black and White Fantail Flycatcher). According to Mathews it seems more probable that the correct name for this host is *Leucouria cockerelli cockerelli* (Rams.).

Specimens examined.—Holotype, allotype, and paratypes from the type-host, British Solomon Islands, Guadalcanal, Lunga, 3. vi. 1935.

A small, weakly sclerotized and pigmented species.

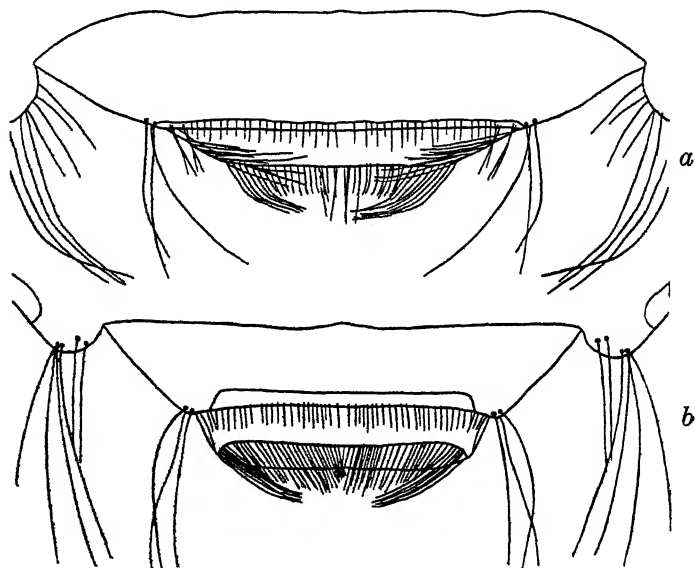
Female.—Head (see text-fig. 4 a) slightly longer than broad, roughly triangular in shape. The antennal bands extending forward to the clypeus, a small area posterior to the eye and continuous with the temporal margins, and the mandibles are the only definitely pigmented area of the head. Trabeculæ about half the length of the first antennal segment. Antennæ simple.

Thorax.—Prothorax about two-thirds the width of the temples and half as long as broad. Sides curved. Two pigmented areas posterior to the first pair of coxæ and running to the sides and laterally. One small seta situated in each of the posterior lateral angles. Meso-metathorax three times as long as prothorax, widening posteriorly to a little less than the temporal region of the head. Two pigmented areas situated laterally and

extending inwards between the 2nd and 3rd coxæ. Posterior margin bears a row of about twelve small setæ. Legs normal.

Abdomen.—Almost three times as long as wide. Lateral margins of first seven segments deeply pigmented—remainder of abdomen faintly sclerotized. Tergites divided medianally. Sternites: rectangular plate occupying roughly two-thirds of the area of each segment. There appears only to be a single long slender seta and another shorter one in the posterior-lateral angle of each

Text-fig. 3.



a. Terminal portion of abdomen of *E. cimicoides* Nitzsch. ♀.
b. Terminal portion of abdomen of *E. mumfordi*, sp. n. ♀.

segment. Terminal abdominal segments not pigmented (see text-fig. 4 b).

Male.—Smaller but similar in every respect to the female.

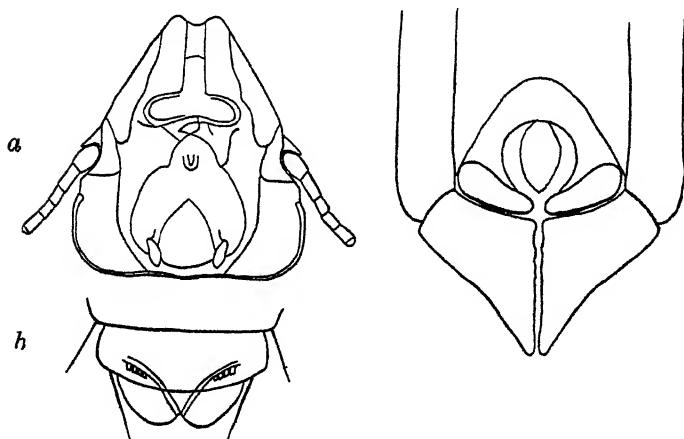
Genitalia (see text-fig. 4 c).

Length: ♀ 1.5 mm., ♂ 1.1 mm.; greatest breadth: ♀ 0.3 mm., ♂ 0.4 mm.

Note.—In dealing with this species I have had a number of specimens before me, but owing to their mode of

preservation before they came into my hands it was extremely difficult to make good microscopical preparations. The male genitalia have been drawn under a high power from a specimen with genitalia contained internally, and much difficulty was experienced in the execution of the drawing. I was unable to detect the presence of a spermatheca in the females, but it is possible that it is very weakly sclerotized, and owing to the condition of the material easily overlooked. It is to be hoped, however, that the accompanying drawings, together with

Text-fig. 4.



a. Head of *Degeeriella rhipidura*, sp. n.

b. Terminal portion of abdomen of *D. rhipidura*, sp. n.

c. Terminal portion of ♂ genitalia (greatly enlarged) of *D. rhipidura*, sp. n.

(All figures, except 4 c, drawn to the same scale.)

the notes and the knowledge of the host from which the specimens were obtained, will enable future workers to identify the species. The head and the terminal abdominal segments of the female were drawn to the same scale, as were all the other drawings in this paper (except the ♂ genitalia of the present species—see above).

EXPLANATION OF PLATE VII.

Fig. 1. *Dennyus francicus*, sp. n. ♀.

Fig. 2. *Dennyus francicus*, sp. n. ♂.

XXXVI.—On *Calamostachys oldhamia* Hick & Lomax, and its inclusion in *C. casheana* Williamson. By WILLIAM S. LACEY (Reading University).

[Plate VIII.]

THIS note briefly describes a specimen of a Calamitean cone recently found in a coal-ball from the Upper Foot Mine *, the well-known horizon in the Lower Coal Measures of Oldham, Lancashire. It is interesting in that it appears to be identical with two other cones described from the same locality, namely *Calamostachys oldhamia* Hick & Lomax (Mem. Proc. Manchester Lit. Phil. Soc. viii. 1894), *Calamostachys* sp., Williamson & Scott (Phil. Trans. Roy. Soc. B, clxxxv. 1895), and also with the much better known species *C. casheana*, of which *C. oldhamia* is thus a synonym.

The new specimen is a fragment about 3 cm. long, lacking both base and apex. It has been investigated by the preparation of thirty-five transverse sections from the upper part, and of fifteen obliquely longitudinal sections from the lower part, by the cellulose peel method †.

The general characters of the present cone are well shown in Pl. VIII. fig. 1, $\times 8$. The axis bears alternate and equidistant whorls of bracts and sporangiophores, both of which have an obliquely upward direction. The axis is of the type commonly found in *C. binneyana*, the stele having an obtusely triquetrous form, and in some sections the carinal canals marking the position of the three pairs of vascular bundles are distinctly shown (Pl. VIII. figs. 1–3). There are only slight indications of secondary thickening. Transverse sections (Pl. VIII. fig. 2) show that there are six sporangiophores in a whorl, and the whorls appear to be superposed. One of the longitudinal sections (Pl. VIII. fig. 3) shows the attach-

* Also known as the Upper Foot Coal, or Bullion Mine.

† The critical sections and the remainder of the cone have been deposited in the Geol. Dept. of the British Museum (Nat. Hist.), registered numbers V 26784 *a-k*. Unfortunately, part of the series was destroyed by enemy action in September, 1940.

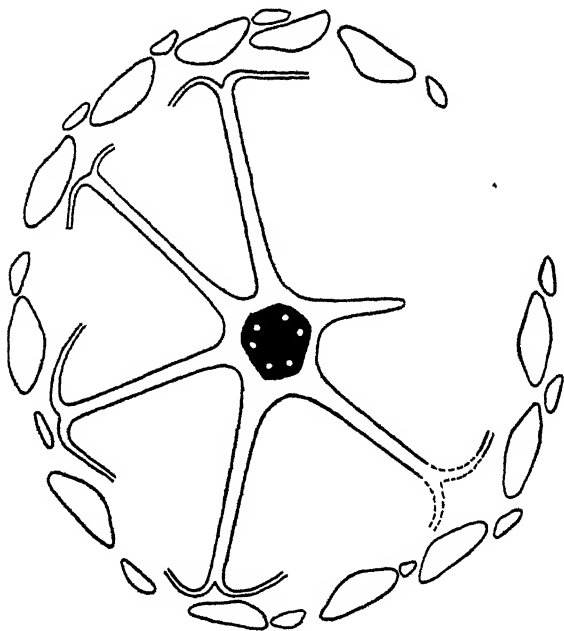
ment of a sporangium to the edge of the expanded head of a sporangiophore, and here, as in fig. 2 (Pl. VIII.), little more than the vascular tissue leading out to the sporangia is preserved. Both these figures emphasise the slenderness of the sporangiophore stalks in comparison with those of *C. binneyana*. The cone is not very well preserved and, as the internal structure of the axis, sporangiophores and sporangium-wall appears to be generally identical with that of *C. binneyana* or *C. casheana*, no description is necessary, the more so as Hick & Lomax have already given details of their cone. The nature of the spores and bracts will be referred to after mention has been made of the other two cones.

Hick & Lomax's cone was cut into two thin sections: one, which appears to have been lost, was very tangential and is scarcely mentioned in the description; the other, an almost perfectly radial section, is now in the Scott Collection in the Geol. Dept. of the British Museum (slide no. 473). This was quite accurately represented by text-fig. 1 in their paper, but it is refigured here for comparison (Pl. VIII. fig. 4, $\times 3$). A re-examination of it has added no fresh information, except that a few corrections can be made to their description, several of the characters on which they relied to distinguish their cone from *C. binneyana* being no longer applicable. Thus they suggested that the sporangiophore stalks were not expanded into peltate heads, since there was no evidence of these in the sections, but well-developed heads are present in the new specimen, though all that is actually preserved is a slender vascular strand passing to each sporangium. They also believed that the sporangiophores were not superposed and that they numbered more than six, but there is no real evidence of this from the section of their cone.

The cone described by Williamson & Scott as *Calamostachys* sp. is the best preserved of the three. The radial and tangential sections made from it (Williamson Coll., nos. 1896 and 1897 respectively, now in the Geol. Dept. Brit. Mus.) are figured in their 1895 paper (Pl. 74, figs. 17, 18).

Spores and Bracts.—A special interest attaches to the spores of these specimens. They are quite well preserved

in Williamson & Scott's cone, but poorly preserved in the other two, most of the sporangia in the new specimen being empty. The intine of the spores is of rather uniform size, about 75μ in diameter, but even in the best preserved spores the intine has shrunk away from it. There is no evidence that any of the spores are still associated in a tetrad within a common wall, nor that there are aborted spores. Macrosporangia are not present. The



Reconstruction of a thick transverse segment of the cone V. 26784. The parts shown are represented by accurate outlines pieced together from several successive sections. The top right corner has been disturbed by an invading rootlet.

spores are therefore exactly comparable with the microspores of *C. casheana*, as Williamson & Scott have already pointed out for their cone, and contrast with the spores of *C. binneyana*, where the abortion of some spores at the tetrad stage is a striking feature.

Another detailed point of agreement of these cones with *C. casheana*, contrasting with *C. binneyana*, is the greater development of thin-walled tissue on the lower side of the horizontal portions of the bracts. In some sections, as in the lower whorl of Pl. VIII. fig. 1, this tissue is fairly well preserved, and it is clear that the bracts were united for some distance from the axis, but it is not known how far the union persisted. In other sections, as in the upper whorl of the same figure, the thin-walled tissue has largely decayed, thereby isolating the vascular bundles with their sclerenchymatous sheath. This appearance no doubt led Williamson & Scott to infer that the bracts of *C. casheana* were less coherent than those of *C. binneyana*, and Hick & Lomax to come to the same conclusion regarding their cone. The removal of thin-walled tissue by decay may have accentuated the abruptly angular transition between the more or less horizontal and vertical portions of the bracts (*cf.* Hick & Lomax's text-fig. 2). The corresponding sclerotic tissue in *C. binneyana*, on the other hand, shows a continuous upward curve. In none of the cones under discussion is it possible to determine the exact number of bracts in a whorl, but it is probably twelve; eleven, and possibly twelve bracts, sometimes alternating with those of the whorl below, can be counted in fig. 2 (Pl. VIII.) (Compare also the reconstruction in the text-figure.)

Summary and Conclusion.

Taking these three cones together we find that they differ from *C. binneyana*, and agree with *C. casheana*, in the following characters:—(1) the obliquely ascending direction of the bracts and sporangiophores, (2) the details of the bracts; (3) the somewhat greater diameter: these cones average nearly 7.0 mm., *C. casheana* over 6.0 mm., and *C. binneyana* only about 4.5 mm.; (4) the slenderness of the sporangiophore stalks; and (5) above all, in the spores. Such detailed agreement justifies their inclusion in *C. casheana* and the consequent suppression of the name *C. oldhamia*. The apparent absence of macrosporangia may be explained by the non-preservation of the lower portions, for it is known that the microsporangia

were borne in the upper whorls. Hick & Lomax's cone being over 4 cm. long, and yet incomplete at both ends, we may suppose that the macrosporangia only occupied a small proportion of the total length.

Both the specimens on which Williamson & Scott based their descriptions of *C. casheana* came from the same locality and horizon* as these cones. The latter confirm Williamson & Scott's statement that *C. casheana* and *C. binneyana* are essentially similar in their morphology, and the transverse sections of the new cone indicate that this also applies to the anatomy of the stele. But at the same time they show that it is possible to distinguish the two species on characters other than heterospory.

Acknowledgements.

This investigation was carried out in the Botany department of Reading University under the direction of Prof. T. M. Harris, to whom I am deeply grateful for constant guidance and criticism. I wish also to thank Miss N. Swindell and Miss N. M. Gibson for help in preparing the sections, the Keeper of Geology in the British Museum (Natural History) for the loan of specimens, and Mr. W. N. Croft, of the British Museum (Nat. Hist.), for many valuable suggestions and for help in the preparation of the manuscript.

EXPLANATION OF PLATE VIII.

Calamostachys casheana Williamson.

Fig. 1. Longitudinal section, $\times 8$. V. 26784d.

Fig. 2. Transverse section, $\times 8$. Slide destroyed by enemy action.

Fig. 3. Longitudinal section, $\times 10$ to show attachment of sporangium to sporangiophore. V. 26784a.

Fig. 4. Radial longitudinal section, $\times 3$. The original of *C. oldhamia* Hick & Lomax. Scott Coll., no. 473.

* One of these, slide no. 1024, was stated by Williamson & Scott (1895) to have come from Halifax, but this is evidently an error, for the locality is given as Oldham both on the slide and in Williamson's MS. register. The other specimen (slide no. 1587) came from Strinesdale Pit, Saddleworth, a few miles E.N.E. of Oldham. Both these slides are in the Williamson Coll. in the Geol. Dept., British Museum (Nat. Hist.).

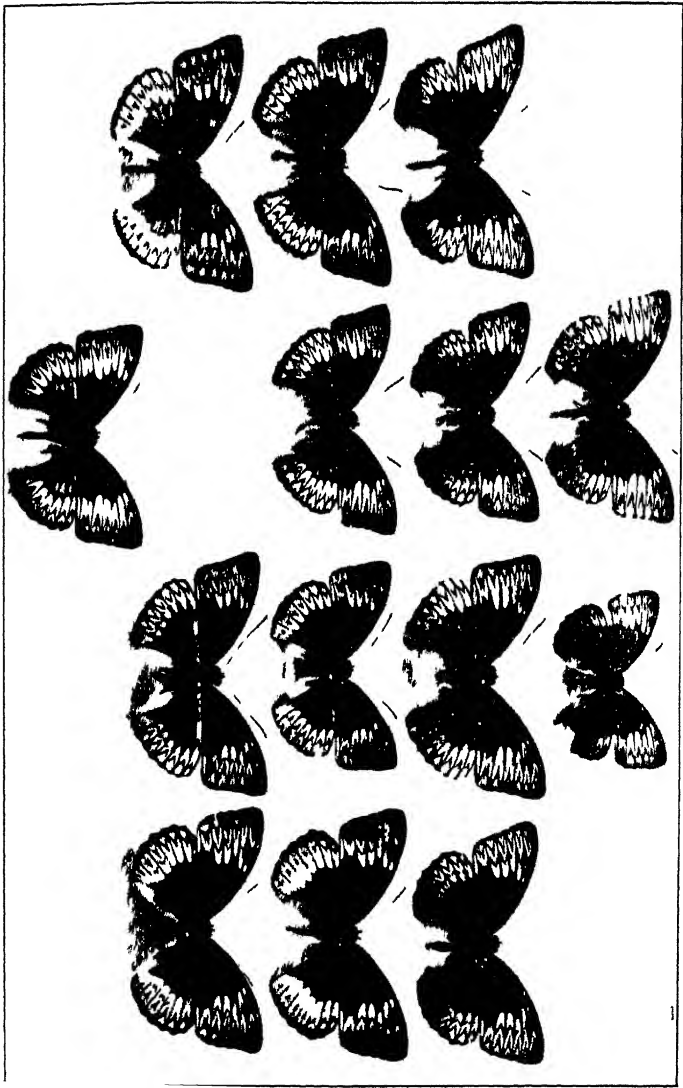
JAVA

BORNEO

SUMATRA

MALAYA

S BURMA



PELEA

PALGUNA

MUNDA

ARUNA.

FIG 1



FIG 2.

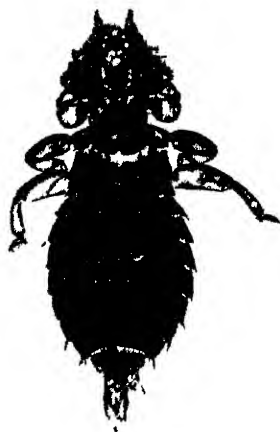
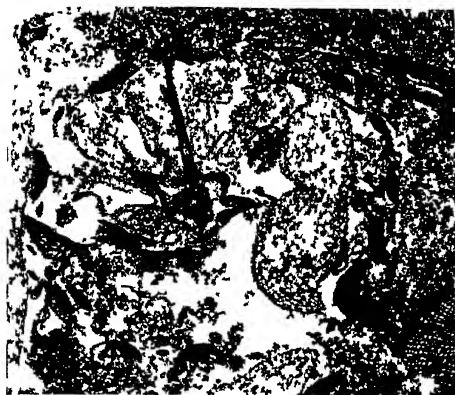


FIG 1.—*Dennyus francicus*, sp. n. ♀.
FIG 2.—Ditto. ♂.



2



3



1



4

Calamostachys casheana.

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